THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXXIV., No. 6. Whole No. 1,600. | NEW YORK, MONDAY, FEBRUARY 5, 1906. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs).

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them. All payments to be made in advance. Single copies, 10 cents.

Collections are invariably made directly from this office for subscriptions advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Thirty-sixth Annual Meeting, New England Association of Gas Engineers 221

NOTICES—
Wrinkle Department, Ohio Gas Light Association 221
Fifth Annual Meeting, Wisconsin Gas Association 221
Gas Works' Tests, Ohio Gas Light Association 222

EDITORIALS—
Briefly Told 222
Notes.
*Vertical Retorts for the Production of Illuminating Gas.—A Proposed Setting 222
*A Smooth Bore Differential Coupling 225
Co-Operative Education 225
*Steam Pipes in Shafts 226
Repairing Engineers' Field Instruments, by Mr. E. M. Douglas 227
*Government Tests of Lubricating Oils, by Mr. A. B. Willits 228
The Municipal Electric Plant, Cumberland, Md. 229
The Management of Small Central Stations, by Mr. Henry Joseph 230
Naphthaline at Sheffield, by Mr. Hanbury Thomas 231
New Uses for Electricity 232

CORRESPONDENCE—
Some Thoughts on New Business 233

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 233
Changes at Princeton, Ills.—Contract for the Gas Machinery Company—Mr. W. A. Aldrich Tells What Happened—Annual Meeting, Grand Rapids, Mich.—Annual Meeting, Pittsfield, N. H.—Cheaper Gas for Nashua, N. H.—Death of Mr. B. Cahn—Annual Meeting, Norfolk, Va.—Special Meeting, Cincinnati, O.—Hints from Cambridge, Mass.—Personal—Annual Meeting, Galveston, Tex.—Annual Meeting, Doylestown, Pa.—Ditto, Portland, Me.—Resolutions Respecting ex-President Daveis—The Boston Chamber of Commerce Has a Word to Say Over Municipal Control—Personal—Personal—And Other Items.

The Market for Gas Securities 235

[OFFICIAL NOTICE.]

Thirty-sixth Annual Meeting, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
SECRETARY'S OFFICE, 26 CENTRAL SQUARE,
EAST BOSTON, MASS., January 8, 1906.

The 36th Annual Meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Tuesday and Wednesday, February 20th and 21st, 1906. The usual number of papers are in course of preparation and, with numerous questions sent in for discussion, the time of the meeting promises to be fully occupied. Members will please note the change from the usual days, on account of Thursday being a holiday. Detailed information regarding the programme, etc., will be mailed to members before the meeting, so that each may come prepared to do his full share, and make the meeting more successful than its predecessors. N. W. GIFFORD, Secretary.

[NOTICE.]

Wrinkle Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE WRINKLE DEPT.,
719 CITIZENS BUILDING,
CLEVELAND, O., June 13, 1905.

The Wrinkle Department of the Ohio Gas Light Association is now ready to receive contributions for the 1906 collection, and a sketch or description of all devices, formulæ and methods of accomplishing objects pertaining to the gas business, is respectfully solicited.

Please send a written explanation, accompanied by any sketch, photograph or drawing, to the above address, or a description alone will suffice.

Hoping to receive prompt compliance,

Yours very truly. W. E. STEINWEDELL, Editor.

[NOTICE.]

Fifth Annual Meeting, Wisconsin Gas Association.

WISCONSIN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
RACINE, WIS., January, 27, 1906.

To the Members of the Wisconsin Gas Association: The Fifth Annual Convention of the Wisconsin Gas Association will be held in Milwaukee, on Wednesday the 14th, and Thursday the 15th, of February, next. Headquarters will be held at the Hotel Pfister where rates will be $1.50 and upwards per day for rooms without bath, and $2 50 and upwards for rooms with bath; all European plan. The best rooms can only be obtained by making reservation in advance of the meeting.

Arrangements have been made for a dinner at the Milwaukee Athletic Club, for the evening of Wednesday the 14th, and a theater party at the Davidson Theater for the evening of Thursday the 15th.

Respectfully yours, HENRY H. HYDE, Secretary.

LIBRARY OF CONGRESS
FEB 5
SMITHSONIAN DEPOSIT

[NOTICE.]

Gas Works' Tests, Ohio Gas Light Association.

The following notification, which is self-explanatory, was received some days ago. Chairman Tuttle's aides on the Committee are: Messrs. W. B. Calkins, Clarence S. Lomax, J. M. Morehead, D. Wilson, E. H. Earnshaw, P. A. Degener, C. C. Tutwiler, M. R. Bump and H. B. Harrop; and they hope that fair and much assistance will be given to them in the undertaking (and a valuable one to the industry it is) that they have in hand.

CONSOLIDATED GAS COMPANY OF NEW JERSEY,
LONG BRANCH, N. J., Jan. 26, 1906.

The Committee appointed by the Ohio Gas Light Association to investigate gas works' tests needs your assistance.

It is proposed that a collection and comparison of all works' tests be made, with the idea of selecting and publishing the best methods.

You are, therefore, requested to advise us in regard to the following questions at your earliest convenience:

1. How do you test the illuminating value of your gas?
2. How do you test the calorific value of your gas?
3. How do you test your gas for H_2S?
4. How do you test your gas for other sulphur compounds?
5. How do you test your scrubbbed gas for ammonia?
6. How do you test your crude gas for ammonia?
7. How do you test your ammoniacal liquor?
8. How do you test the various kinds of coal you use?
9. How do you test your iron oxide of sulphur?
10. How do you test your gas oil?
11. What other tests do you make?
12. What criticism have you for any of the methods you use?
13. Are there any tests that you do not make, but would make if you knew of a good method?
14. Are there any tests not mentioned above that you would like information about?

In answering each of the above questions please describe fully both the apparatus used and the way in which you make the test.

A stamped envelope is inclosed herewith for your reply.

Very truly yours, W. B. TUTTLE,
Chairman Committee on Select Gas Works' Tests.

BRIEFLY TOLD.

NOTES.—

MR. E. H. GIMPER has resigned the position of Superintendent of the Eastern Wisconsin Railway and Light Company's plant in Fond du Lac, Wis., to become the General Manager of the plant at Spokane Falls, Wash. The correspondent who gave us this advice further writes: "Mr. Gimper came to this city last May from New Orleans. During his residence here he has made many friends, all of whom will regret to learn of his resignation, but who will be pleased to learn of his advancement. Until his successor here is appointed, the local office will be in charge of M. L. Jones."

AT the annual meeting of the shareholders of the Wilkes-Barre (Pa.) Gas and Electric Company the officers chosen were: Directors, Robert L. Forrest, P. G. Gossler, H. S. Graham, G. B. Luinard, J. N. Thompson, C. C. Cuyler and F. H. Shelton; President, Robert L. Forrest.

Two of the prominent exhibitors at the permanent exhibition of building materials that is to be carried on at the Builder's Exchange, Baltimore, Md., will be the Baltimore Retort and Firebrick Company and the Consolidated Gas Company.

MR. FANCHER, of the Fire Department of New Haven, Conn., recently acknowledged the receipt of a check calling for $50, which was awarded by the New Haven Gas Light Company as a "mark" of appreciation of the efficient work done by the department at the fire in the Company's works the last week in January.

MR. C. W. FAIR has been appointed Manager of the gas properties controlled by the Heald-Stevens syndicate.

THE officers elected at the last meeting of the Greenfield (Mass.) Gas and Electric Light Company were: President, J. W. Chapin; Vice-President, J. E. Davis; Secretary, T. W. Johnson; Treasurer, L. D. Slate.

ACCORDING to City Accountant Gridley, his audit of the books of the Detroit City Gas Company, respecting the money paid in on license account was correct, despite the suggestions made by a man named Kellogg, formerly in the employ of the Company, that the accounts were "doctored."

Vertical Retorts for the Production of Illuminating Gas —A Proposed Setting.

By MR. W. R. HERRING, Edinburgh, Scotland, in the *Journal of Gas Lighting.*

To the uninitiated the vertical retort benches in the Scottish oil works are all similar in design, in the same way that the retort settings in all gas works may be said to be alike. But there are, from a technical point of view, differences in design, both in the shape of the retort, its form of setting, the methods employed for charging, and, perhaps more particularly, the methods employed for continuously discharging the spent shale from the base of the retort. In principle, however, they may be said to be alike. Therefore, in dealing with this matter, I have selected a type of retort which appears to me to be structurally best suited for the carbonization of bituminous coal, and have altered its setting so as to meet the requirements of coal gas manufacture. This retort is known as the "Pumpherston," and is illustrated upon Drawing No. 3.

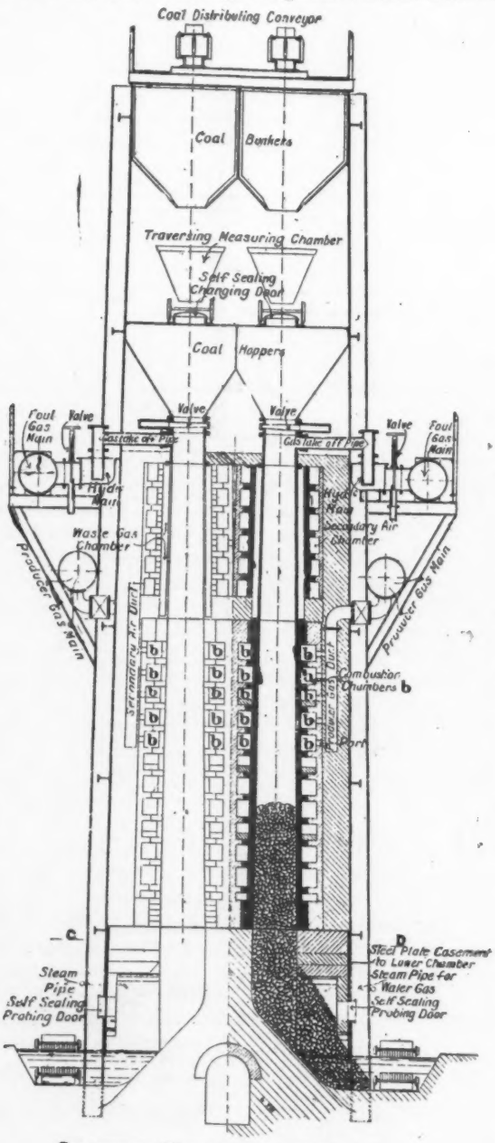
It will be seen from the illustration that the retort is constructed in circular form of specially made circular shaped bricks, alternating with 1 course in every 3 or 4 of bricks so shaped as to form a stay or strut between the retort casing proper and the chamber within which the retort is set. The retort is also tapered, being 28 inches at the top and 36 inches at the bottom. It is 20 feet long, and has a cubical capacity of 108 cubic feet. The intervening space between the outer circumference of the retort and the casement of the setting is the area within which the producer gases are consumed and circulated for heating the retort; they being made to descend from the upper to the lower portion of the retort in an elongated spiral flow to the base, where each retort discharges into a chimney or flue common to 4 retorts, which may be divided or not, ascending to the level of the top of the fireclay retorts, where it is divided into 4 channels and made to circulate between the outer casement of the upper or iron portion of the retort and the firebrick casement dividing the secondary air chamber from the outer casement of the bench—Drawing No. 2. The flow of the products of combustion is controlled by dampers to each quarter section on leaving the top part of the setting and collected into a main flue, or by means of individual chimneys discharged into the air.

The fireclay retort is, as already stated, 20 feet long, and the iron portion 10 feet; the latter having a cubical capacity of 35 cubic feet. There is then the neck, with the cut-off valve intervening between the mouth of the retort and the coal storage hopper—the valve being closed at such times when the hopper is being recharged with coal. When it is found impossible to close the valve, this fact alone indicates that a fresh supply of coal is not required in the upper hopper; so that at no time is it necessary to open the self-sealing door of the upper hopper until the communication between the retort and the outer air has been closed by the valve. The total cubical capacity of the iron and fireclay retort combined, so far as its active carbonizing capacity is concerned, is therefore 3¼ tons.

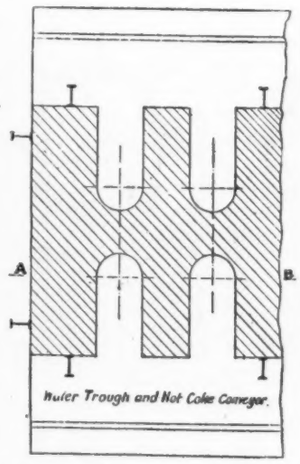
Many are the devices used in the oil works for extracting the spent shale from the base of the retorts. As this material consists of a small, slaty residue, however, it can be easily dealt with mechanically and in a way which the residue from bituminous caking coal would refuse to respond to; and considerable modification will be necessary to make this portion of the setting a success. Upon the General Drawing No. 1, I have shown an arrangement which provides an inclined plane at the base of each retort, of larger area than the lower part of the retort, so that, as the contents of the retorts descend, they are directed outwards, through an opening in the casement into the water trough at the base, the water forming a seal as well as playing other important parts. At the point where the coke is discharged a coke conveyor is arranged to carry it away automatically—not only such of the coke as floats on the water surface, but also such portions as sink to the bottom of the trough. An ordinary self-sealing mouthpiece is provided above this aperture, in a position where the coke is already quenched; so that should any choking take place, the door may be periodically released for a few moments without necessarily interfering with the working of the setting. The shale retorts are usually grouped in 4's in a bench of any number of sets. I have, therefore, followed the same policy in this respect, and will now proceed to describe the method of working a bench such as is shown.

The heat applied for the process of carbonization must, in the case of gas works, be obtained from separately worked outside producers, and the gas conducted by means of a main (which is shown supported beneath the hydraulic main) and branches taken therefrom conducting

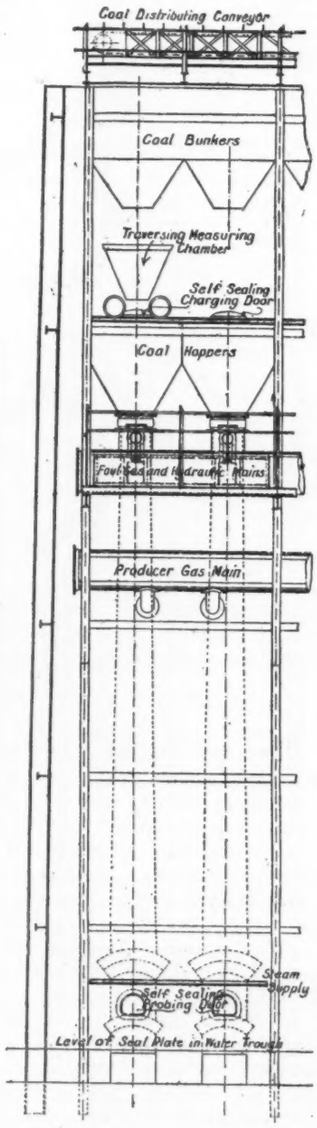
DRAWING NO. 1.—*Herring's Proposed Vertical Retort Setting for the Simultaneous Production of Coal and Water Gas.*



SECTIONAL ELEVATION ON LINE A B.

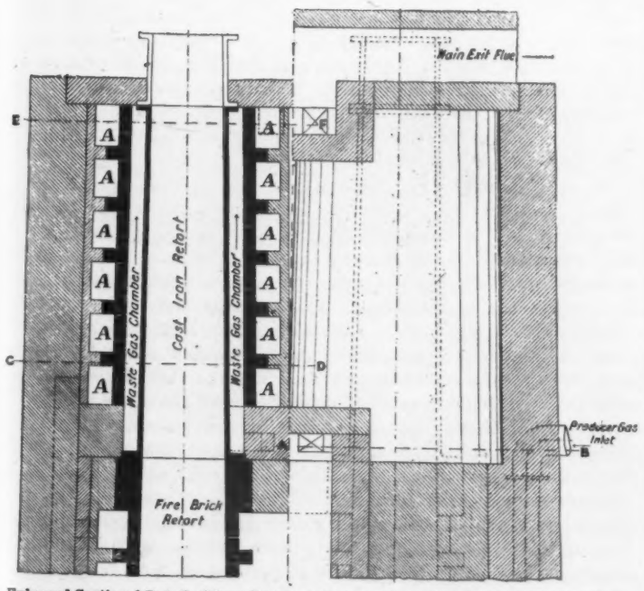


PLAN OF BASE ON LINE C

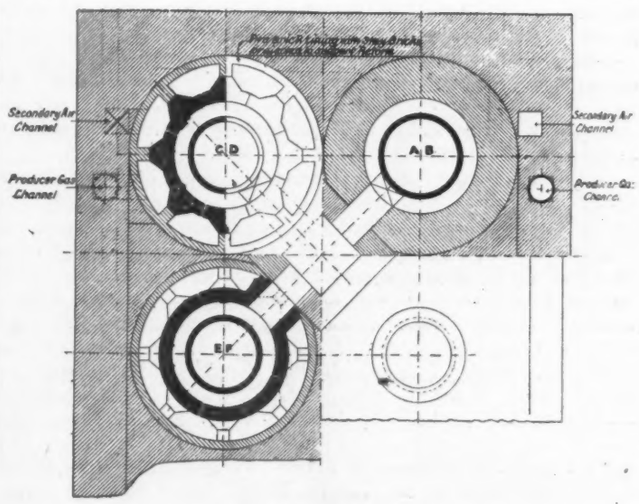


FRONT ELEVATION OF SETTING.

DRAWING NO. 2.



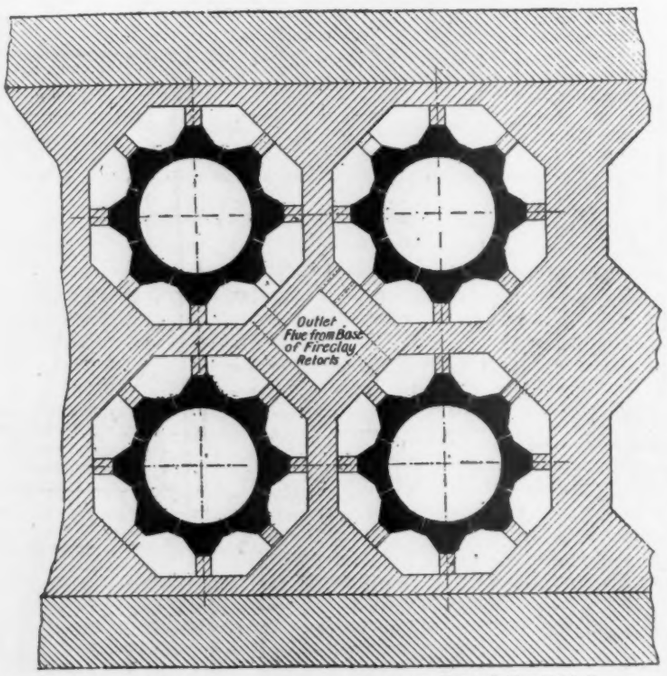
Enlarged Sectional Detail of Iron Retort and Waste Gas and Secondary Air Chamber.



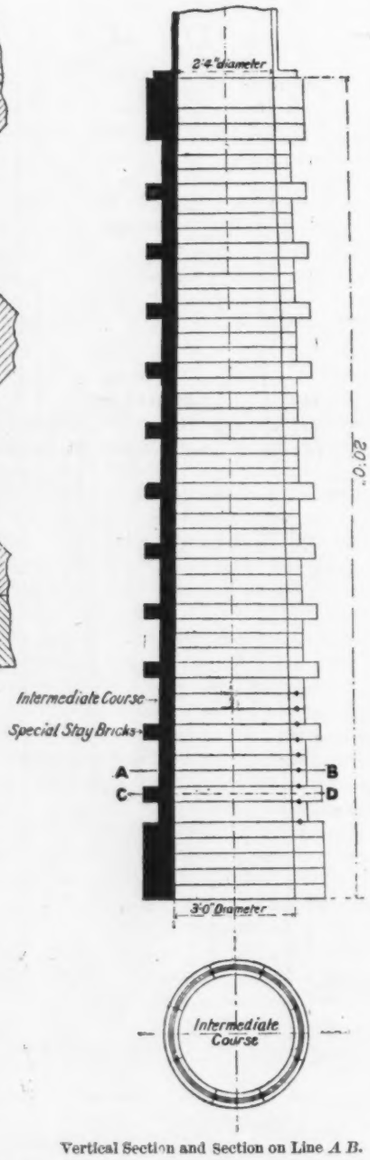
Part Plan on Top of Iron Retort.

A B—Part plan on line *A B*, showing entrance from upright flue to waste gas chamber.
C D— " " *C D*, through stay bricks forming secondary air chamber.
E F— " " *E F*, showing outlet and waste gas chamber to main flue.

DRAWING NO. 3.



Plan of Setting on Line *C D* (with Retorts Shown in Section) Through Stay Brick Course.



Vertical Section and Section on Line *A B*.

the producer gas into channels descending from the top of the fireclay retort downwards for a distance of about one-third, or perhaps to one-half, its total length, and discharging, by means of ports, into the chamber intervening between the retort and the casement of the bench. The secondary air is obtained by it being admitted into the secondary air chamber shown on Drawing No. 3, which is an annular space surrounding the flue encircling the iron portion of the retort. The secondary air is made to descend in a similar channel to the producer gas, and by means of similar ports comingles with the producer gas in the chamber surrounding the retorts. The products of combustion so formed are made to descend, by means of baffle bricks, in an elongated spiral form to the base of the retort.

The reason for bringing about combustion around the upper part of the fireclay retort is based on the theory that the coal, after being partially prepared for carbonization in the iron portion of the retort, first descends into the upper part of the fireclay retort. It is at this stage that the greatest activity prevails, and, consequently, the greatest absorption of heat takes place. As the charge descends, it is more or less spent, and by the time it reaches the bottom is completely so, and in the condition of an incandescent mass at a high temperature, ready for treatment for the recovery of ammonia. It is as well to state at this stage that the method of heating, and also the jacketing of the iron portion of the retort with the waste gases so as to heat the secondary air, differ completely from what is practised in the shale oil retorts in Scotland, and is really what I am of opinion would be one of the best ways of treating a setting such as has been described for coal gas manufacture. This will be more particularly referred to in a future article.

Let me assume for a moment that such a bench of retorts is to be brought into work. The retorts are primarily heated by direct firing within the retort itself, by first charging it with coke to about half way up the fireclay portion—the coke so charged being ignited at the base, and an air supply admitted to assist the combustion, the top valve and the cover on the coal hoppers being opened. As soon as the retort is sufficiently heated to make it safe to admit producer gas into the combustion chamber surrounding the same, producer gas is admitted, together with the secondary air supply, and the ordinary process of heating is gone on with. When a carbonizing temperature is reached, the ash produced by the direct combustion within the retort must be removed, and the retort filled up with sufficient coke to form the bed upon which the coal is to rest. Thereafter the retort, including the iron upper portion and the hopper, would be fully charged with coal in the ordinary way, and the outlet valve on the gas take-off pipe leading to an ordinary type of hydraulic main opened, and whatever vacuum might be found necessary maintained in this main and, consequently, in the retort. We must further assume that the dead coke put into the retort to form the base upon which the charge is to rest has also been removed as the process of carbonization advanced, and that the coal has now assumed its normal position within the retort—that is to say, that red-hot coke has already descended into the lower chamber beneath the retorts, and that the process of carbonization is normally proceeding in the fireclay retort above. With such an arrangement, there will consequently be several distinct stages of the process proceeding simultaneously, each of which is of considerable importance to the other.

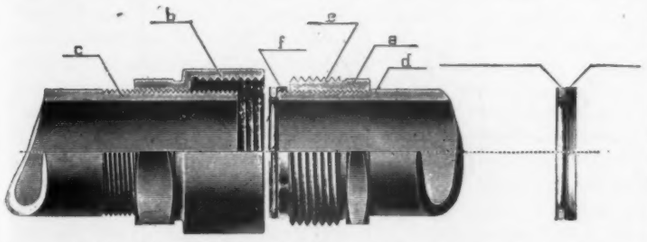
Let me first deal with the coal gas. The coal in the vicinity, or (say) in the upper half of the clay retort will be in a rapid process of distillation, and its completion more or less active as it descends. The resultant gas will ascend, passing through the coal in the iron portion of the retort, which itself is externally heated by the waste heat after leaving the base of the fireclay retort setting, and has consequently very nearly approached the carbonizing stage. It will also act as a filter and retain within the retort volatile matters which would otherwise condense out as fluids were they to make their escape from the retort without this intervening mass. The gases generated in the lower portion of the fireclay retort will be of a much poorer quality, of less volume, and necessarily hotter, than in the upper portion of the retort, where the active distillation is taking place. These poorer gases, including the water gas formed at this stage, will consequently enrich themselves at the expense of the richer gas and the lighter hydrocarbons yielded in the upper portion of the retort, and such as may be deposited in the material in process of preparation for carbonization in the iron portion of the retort in passing through the charge.

The charge of coke in the bottom of the retort and in the lower chamber will be in a highly incandescent state, free of all volatile matters such as we know it to be at the expiry of the ordinary carbonizing period. The heat thus present in the spent charge, and which is now utterly lost, is to be, in this case, utilized for the production of water gas; steam being admitted in just such quantities as will absorb the whole of the heat and render the coke ready for displacement at the base, quenched and practically cold. The process of the withdrawal of coke and the charging of coal being continuous and automatic, the water gas so formed at the base of the retort will still have the full length of the incandescent retort to travel through in the presence of its carbonaceous contents; and it will thus insure its conversion into a permanent gas. Whether by this means of producing water gas with a limited quantity of steam we shall attain the same results as are obtained in the oil works—where, by the use of a liberal quantity of steam at the base of the retort, they are enabled to recover very greatly increased percentages of the nitrogen as ammonia originally contained in the shale—is a matter of considerable importance, and one which I propose to deal with in the next article.

Generally speaking, the construction of the bench is very similar to the shale settings in Scotland; and the adaptations are merely such as, in my opinion, may be the correct ones to adopt in order to adapt them to the requirements of coal gas manufacture. It will be seen that I have introduced the continuous coal storage hopper above the bench, which is fed by a continuous conveyor; the whole being supported upon the superstructure of the bench. The continuous storage hoppers are made to feed into traversing measuring chambers, whereby the quantity of coal charged to each retort can be accurately recorded. The movement of the charge of coal from the top to the bottom of the retort, and its efficient carbonization, will not, I think, present any difficulties. In the first place, the retort is substantially tapered. The natural movement of the material within it is thus for the contents in the center to sink, with the natural result that portions of the charge at the sides ultimately fall into the center—the charge as it were continually rolling upon itself, from the surface of the retorts inwards to the center, in the same way that grain, or even coal, discharging from a hopper with an outlet at the base. On first opening the discharging aperture, the coal, like grain, draws down the central axis over the opening, and feeds itself from the upper layers rather than from the lower layers immediately in the vicinity of the opening; and the enlarging diameter of the retort as the charge descends will assist in this motion being fairly uniform, and thus insure a constant change in the position of the charge in relation to the active heating surface of the retort—the circular form of retort aiding greatly to the constantly changing position of the charge.

A Smooth Bore Differential Coupling.

The last number to hand of the *Gas World* illustrates and describes a new patent pipe coupling which is being put on the market by Messrs. Edward Le Bas & Co., Engineers, of London, Glasgow and Manchester, under the name of the "Smooth Bore Differential Coupling." It will



be seen that the pipes are joined so as to retain the full bore at the connection, and that two parts only are required, as compared with three in the ordinary union. The ends of the pipes are screwed to standard Whitworth gas thread, and the two parts of the coupling are screwed upon these. In making a joint, the two sockets are screwed upon the two pipes up to the ends of the threads upon the latter. A copper washer with asbestos filling is next placed over the end of the pipe, *d*, and then the socket, *b*, is screwed home upon the thread, *e*. This thread has a coarser pitch than the others, this being the main feature of the coupling, as, owing to the differential pitch of the threads, an enormous pressure is exerted on the pipe ends, between which the packing ring is placed, and thus a perfectly reliable and durable joint is secured. It will be seen that there is only one possible point of leakage, as against three in other unions, and that the gas or liquid being conveyed cannot come in contact with the coupling or the threads—a feature of great value when the work to be done is the conveyance of corrosive gases or liquids.

Co-Operative Education.

In the address delivered by Professor Herman Schneider, before the Cincinnati Metal Trades' Association, at the close of last December, he remarked that all specialized education can be brought down to the basis of a business proposition by dealing with it as a manufacturer deals with the making of a machine. The problem is: Through what processes must the raw material be put in order to turn out the required finished product? The subject, therefore, is naturally divided into 3 parts, considering now the higher technical man—namely: 1. What requirements must the finished products fulfill? 2. What is the best raw material and how can it be obtained? and, 3, What shall be the method of manufacture? A consideration of the first question would lead to the conclusion that the college graduate should possess the following qualifications:

He should be firmly grounded in the fundamental principles of science. He should be able to supply these principles in practice. He should be specialized as far as possible. He should possess a knowledge of achievments in other fields of engineering. He should be equipped to deal with a situation involving a knowledge of fundamental business forms and processes. He should know men as well as matter. He should have a fair degree of culture. He should be drilled to do his best naturally, and as a matter of course to obey implicitly, to command intelligently and with toleration, to be accurate and systematic and to write clearly and concisely.

Under present conditions our engineering colleges admit to their courses any young men who pass certain written examinations or who come from accredited preparatory schools. A weeding out process takes place after the young men enter, and is passed solely on academic efficiency.

Every graduate represents on the part of the college an expenditure of a certain amount of that school's endowment interest. For a certain endowment a certain number of men can be taught. The efficiency of these men, and consequently that of the school, depends upon their quality. This latter factor—quality—is measured by the engineer's productive capacity in practice. And this, in turn, seems to be a product of three elements—namely, a robust and vigorous body, an equally robust and vigorous mind properly trained and the engineering temperament.

The necessity for the first of these is self evident when one considers the physical vicissitudes the average engineer must undergo. Moreover, if he rises to a position of great responsibility it is absolutely essential that he have a constitution strong enough to withstand the fatigue of mental stress. That the second element is an essential is also self evident.

The third introduces a phase of the situation rarely considered when a candidate presents himself for entrance to an engineering school. Indeed, under existing methods it would be quite impossible to hazard even a guess upon this part of the applicant's equipment. And yet, in the speaker's opinion, this is as great a factor in one's success as any. We all know of men who have been educated in engineering, who have failed as practicing engineers, but who, having wisely abandoned an uncongenial field, have become successful in other professions. We are familiar, too, with the more unfortunate one who, entirely unfitted temperamentally for engineering work, unwisely continues at it and struggles through a laborious, dissatisfied existence; whereas, had cognizance been taken of his aptitudes before his college career, he might have been successful in another sphere of action. That some attention be paid to this part of his capital is due not only to the young man himself, but also to society in general because of the losses it suffers through misdirected energy.

It requires certain peculiar gifts of nature to make a successful lawyer, doctor, theologian or philosopher. So also does it require certain tendencies and aptitudes for a successful practice of engineering. As the phrase of the day has it, certain men are "cut out" to be engineers.

An effort should be made to obtain these men. The speaker does not think that all raw material which presents itself and passes certain mental examinations ought to be accepted, nor does he believe that the process of elimination by examinations during the college course leaves a residue of the best material obtainable. He advocates the adoption of a system which will secure as nearly as possible such raw material as

will, when properly prepared, make the desired finished product of the school.

Any plan, therefore, looking to improved conditions, must select young men mentally and physically sound and clean, temperamentally adapted to engineering and serious in their purpose. It should further give opportunity to men who possess these qualifications but whose financial condition is such as to make the college course an impossibility to them. My plan is as follows:

The owners of the metal trades industries will send to the College of Engineering of the University of Cincinnati their brightest young men who possess a natural mechanical aptitude. These young men will work alternate days at the University and at the shops. They will be sent in pairs alternating with each other, so that when one young man is at the college the other is at the shops, thereby entailing no financial sacrifice on the owners of the shops. The course will probably cover a period of 6 years. Such young men as are not prepared to enter the University will prepare at the Ohio Mechanics' Institute or wherever feasible in the night courses. Young men who finish the University course will be given the technical degree of mechanical engineer. The University will make the course sufficiently elastic to permit the training of young men for predetermined conditions. For instance, if it is desired to train a young man for the position of salesman, his course will be modified to enable him to take up such special subjects as the employer may suggest.

The University will endeavor to show the advantages of this project to the young men of Cincinnati and vicinity, and will urge them to enter the shops by personal talks in the public schools and wherever ambitious young men can be reached. It will mail to the parents a simple and clear statement of the plan of co-operative education, and will advise that their sons aim to a high technical training through the shops.

The young men selected will be paid half time by the shops, inasmuch as they work half time, unless the shop owners desire to make a more liberal arrangement. This will enable the student to pay his college expenses, and if he works every day during his college vacations, to save a small sum additionally. For deserving young men who have to meet all their personal expenses, such as board and lodging, or who must help support a family, some other provision must be made. It will be necessary to raise a fund from which such men could borrow on their personal notes enough to enable them to finish the college course. After graduation when they are receiving the higher wages of highly trained men, they can easily meet the debt in a year or two.

The University expects further to offer night courses in higher technical work, and also in shop accounting, cost keeping, etc. In short the College of Engineering of the University will make every effort to bring itself within reach of any poor boy, and also will endeavor to make itself a source of great benefit directly to the industries of Cincinnati.

Steam Pipes in Shafts.

By Mr. R. D. O. Johnson in *Engineering and Mining Journal.*

A steam pipe down a shaft is one of the problems about mine equipment that is, with good reason, generally regarded as never more than partially solved. It is nearly always a fruitful source of repairs and anxiety.

The difficulties arise mainly from the necessity of caring for the expansion and for the strains that arise therefrom. Various expansion joints have been devised, relying for their action upon the flexibility of coiled or looped sections, or the movement permitted by "fitted" sections or the ordinary gland and stuffing box. The coiled or looped sections, though performing their office admirably if they contain a great enough length of pipe, have the disadvantages of being expansive and of taking up valuable room in the shaft. "Fitted" joints or sections are cheap and usually "home made," but soon become leaky and do not admit of ready repairs. The gland and stuffing box expansion joint is the very worst. It needs constant attention to keep it tight. It accomplishes a complete section of the pipe, the portions of the pipe above and below, being discontinuous, are thrust apart upon the admission of the steam by a stress equal to the product of the area of the pipe and the pressure of the steam. This puts the pipe under a buckling strain which it is not fitted to stand. In spite of the pipe being held in line by staple or U-bolts at each timber, it usually yields to the strain, with the result that the parts of the stuffing box joint separate rather than close up as desired to take up the expansion of the pipe. This style of joint aggravates the trouble it is designed to prevent. The pipe subjected to a frequent recurrence of buckling strains, becomes leaky at every point where there is opportunity.

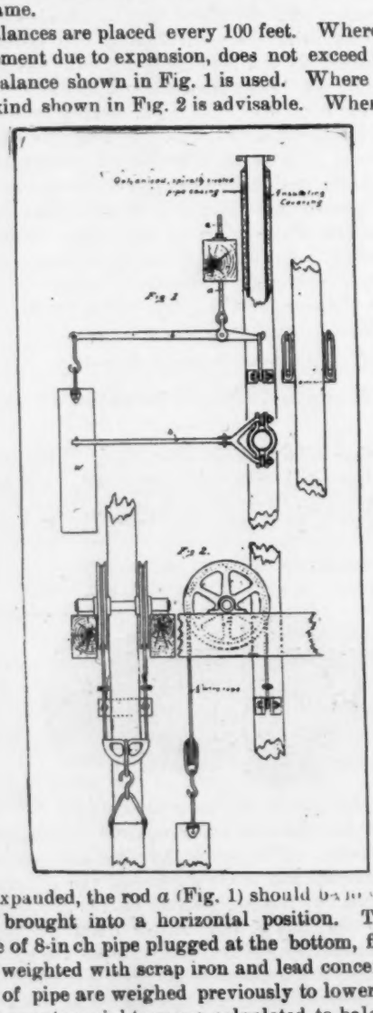
The following arrangement, which I devised and employed in the shafts of the St. Louis Smelting and Refining Company at St. Francois in the lead district of southeastern Missouri, overcame the usual difficulties and made the steam pipes down the shafts parts of the equipment to be forgotten.

The central ideas of the scheme were to throw all of the expansion to one point, the bottom; to keep the pipes at all times under a moderate tension; and to relieve the pipes, when hot, of all stress other than that due to the pressure of the steam.

The pipes were made up in 60-foot sections fitted with an extra heavy flange on each end. The flanges were turned, faced, and scraped so that when bolted together they were steam tight without the use of gaskets of any kind. The 60-foot sections were made up complete on the surface ready to be lowered into place. The pipes were covered with a high grade magnesia covering, over which was slipped a tight casing of galvanized, spirally riveted pipe. At the flanges, the casing was crimped over the covering and all spaces in the crimping, or at the points where the clamps came through the openings, were filled with plaster of paris and painted with tar to prevent any water getting access to the covering. This means of protecting the covering is much superior to the usual one of wrapping with strips of canvas and painting, and considering the labor saved, it is not much more expensive.

A plumb line is dropped down the shaft at the desired point, the timbers intended to support the pipe are marked accordingly and the counter balancing apparatus placed. The bottom section is next lowered into place and temporarily supported until the next section is placed, when the lowest counter balance is attached. The succeeding sections are then lowered and the counter balances attached until the top is reached. The top section is then solidly clamped to the timbers of the gallows frame.

The counter balances are placed every 100 feet. Where the expansion, or the movement due to expansion, does not exceed 5 inches, the style of counterbalance shown in Fig. 1 is used. Where that amount is exceeded, the kind shown in Fig. 2 is advisable. When the pipe is



hot and fully expanded, the rod *a* (Fig. 1) should be so adjusted that the lever arm *b* is brought into a horizontal position. The weight *w* is made of a piece of 8-inch pipe plugged at the bottom, fitted with a bail at the top, and weighted with scrap iron and lead concentrates.

The sections of pipe are weighed previously to lowering to place in the shaft. The counterweights *w* are calculated to balance the 100 feet of covered pipe below, leaving an excess of 100 pounds in favor of the pipe unbalanced. This excess weight is sufficient to keep the pipe in slight tension at all times. Where the total length of the pipe is very

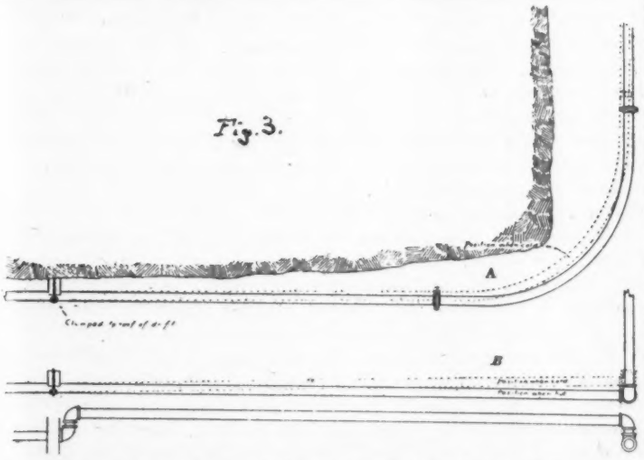


Fig. 3.

great, 100 pounds excess would be too much to be left unbalanced, as the unbalanced weight has to be carried by the top sections. In very deep shafts, it would be advisable to use the counterbalances every 50 feet for the first 200 or 300 feet, to prevent too great tension on the upper sections.

The expansion joint shown in plan at *C* was the one which I employed. Experience indicated that the forms shown in *A* or *B* would have been preferable. Of the latter two *A* is to be preferred over *B*, as it does not depend for its movement upon turning on a threaded joint. Some of the flexible steam joints, like the Moran joint, could doubtless be substituted for the double fittings shown at *C*.

An expansion section of the *A* or *B* pattern should be so put in that it would be under a strain only when the pipe is retracted and cold. When hot the pipe would then assume a position of no strain.

There is a decided advantage in making up the pipe in sections. By this method, the work can be done entirely on the surface where every facility may be at hand for doing a good job. It is cheaper and much more satisfactory than work done in cramped and badly lighted spaces.

An extra complete section should be kept in stock on the surface to immediately replace any section that may be damaged by accident.

Repairing Engineers' Field Instruments.

By Mr. E. M. Douglas.

The writer has frequently noticed the lack of ability on the part of many engineers to make minor repairs to their field instruments. If one is so unfortunate as to fall while carrying an instrument it generally results in so damaging it as to render it useless to the average assistant. At such times the man with some mechanical skill and a few simple tools can make at least temporary repairs, and thus save his employer considerable expense. In such an emergency an engineer who will not make an earnest attempt to repair the damage is not deserving of that honorable title. Every engineer whose work takes him some distance from a city should keep with him a few tools, such as a pair of flat pliers, a small file, large and small screw drivers, a spool of soft brass or copper wire, a pocket knife, also an extra level phial, an ounce or two of plaster of paris, and a bottle of liquid shellac.

The young engineer should be familiar with the details of construction of the instruments he uses, and it is to be regretted that more instruction is not given in technical schools on this important subject. The catalogues of most instrument makers give valuable information regarding their own instruments, and also many suggestions of general application, which it would be well to study carefully.

Suppose a transit has a tall; the standards are probably bent and a level vial broken. Many men would start for town at once under such circumstances and possibly lose several days' time in having repairs made, but remember that the successful engineer is the one who "does things" and never admits that he is "stumped." If you are of this kind, take the transit apart, lay the bent standard on a flat block of wood, and with another block of wood and a hammer or mallet proceed to straighten it. This will not be an easy task, but it can be done. The level tube should then be taken apart and cleaned out, the extra level vial inserted and blocked up with a leaf from the note book, taking care to get the marked or convex side of the tube uppermost. If the level divisions are not cut on the glass, look for a small file scratch near one end of the vial, or if that is not apparent, put that side up which shows inside signs of grinding. Mix up a spoonful of the plaster of paris with water and place a portion around each end of the glass. In a few minutes this has hardened and the tube can be replaced.

Is one of the adjusting screws broken? Whittle out a new one from a piece of hard wood, fastening that end also if necessary and possible with a piece of copper wire.

Broken tripod legs are easily repaired with a piece of wood and some string or wire held in place by shellac. You may not make a neat job of your repair work, but don't mind that if you are able to complete the work assigned you without loss of time.

The writer has in mind a man of considerable skill in certain lines, who had "accepted" an offer of a responsible position and had been placed at work. As a result of a moment's carelessness, an alidade ruler was slightly bent, and without attempting to repair it he rushed to the nearest telegraph office and sent a message to his chief, reading: "I have bent my alidade ruler. What shall I do?" The answer which came was, "Straighten it." This he easily did. At another time a levelman telegraphed: "Cross wires broken, send another level," although he knew that to do so would result in a delay of several days, but the answer he received was, "If you can't insert new cross wires disband your party," and with the possibility of discharge as a stimulant he found that the repairs were easily made. Still another levelman, who could not catch his chief by telegraph, stopped the work of his party and sent his Y level nearly 1,000 miles to an instrument maker in order that the eyepiece might be centered on the cross wires. He could have remedied that trouble in 5 minutes by the proper manipulation of a screw driver. No error would have been introduced into his work, even if the cross wires were not in the center of the field of view so long as the usual level adjustment had been made. This man had not learned to distinguish between a blemish and a fatal defect.

During the past year in certain instrumental work under the writer's charge an expense of over $50 was incurred in having new cross wires inserted by an instrument maker, not including the loss of time by the various parties.

Broken cross wires are of frequent occurrence and are easy to replace if one knows how, consequently the writer is now requiring his assistants to learn how, and in order to aid them has prepared a description of the process, which, as it may be of use to others, is here given in full:

A small bottle of shellac dissolved in alcohol (preferably a thin solution, as that will dry quicker) and a cocoon of spider web are needed. The only tools required are a pair of dividers, or a 6-inch piece of soft iron or copper wire bent to a U, but if neither is available a forked stick will answer. The dividers, wire or forked stick should have a small piece of beeswax pressed around each end to hold the web. A couple of small pointed sticks the size of matches are useful.

The best cocoons for ordinary use are yellowish brown, about ¾-inch long; they may usually be found in dead or hollow trees, or under the bark of old stumps. Good ones may often be found under rocks or in old barns or greenhouses. Occasionally single webs, which may be used in an emergency, may be taken from grass or bushes or limbs of trees; these are generally rough and dirty, but some of their defects may be removed by gently rubbing them with a small stick. If a very fine web is needed it may be secured from a small white cocoon. A good cocoon will furnish enough webs to last for years, and each chief of party should have one packed with the shellac in his instrument box. The best web obtainable can be secured by making a spider spin one as he falls from the end of a stick. A small spider will probably spin a fine web, and a larger spider a coarser web; such webs are always smooth and free from dust. If the spider is made to jump from the end of the dividers or forked stick, the web can be wrapped around the ends and so be in position for immediate use.

Take the instrument which needs the new cross wires to a place sheltered from wind and dust. Unscrew and remove the eyepiece slide without disturbing the object glass. Take out two opposite capstan-headed screws of the four which hold the cross wire ring in its cell and loosen the other two, Using the latter as handles, revolve the ring 90° and insert one of the pointed sticks through the end of the telescope tube into a screw hole, and, while using it as a handle, remove the other screws and take out the ring. Clean the lines of the reticle ring from all old shellac or dirt and lay it on a board or table with the marked side up. Draw some of the web from the cocoon, either with the fingers or with one of the moistened pointed sticks. Keep pulling and working the tangled mass until an inch or two of single web is

drawn out. Attach the ends of the web to the dividers, or wire, by winding them around the wax and pressing them in with the fingers, or wind the web around the forked stick, fastening it with shellac. Examine the web for defects by means of a pocket magnifier or the eyepiece from the telescope. If the web is satisfactory in size and quality, moisten it by dipping it in water for a few seconds, or by breathing gently on it a few times. As the wet web lengthens, take up the slack by opening the dividers, or by bending the wire or stick, but do not attempt to stretch the web more than about $\frac{1}{16}$-inch from its original dry length. Place the web (still on its holder) carefully over reticle, allowing the holder to rest on the table, thus stretching the web slightly, and move it about until it falls exactly in the center of the opposite line, using a magnifier to insure accuracy. Put a small portion of the liquid shellac over each side of the web about $\frac{1}{16}$-inch from central opening of the reticle and leave undisturbed for 3 or 4 minutes, or until the shellac hardens. While the shellac on one web is drying another can be prepared. After all are set, replace the reticle in the telescope by reversing the method used in removing it. When in place the cross wires should be on the side of the rig toward the eyepiece.

Instruments such as the prism level, dumpy levels and transits, not provided with wyes or similar devices for adjusting the cross wires, may be put in close adjustment by means of improvised wooden or metal rings in the following manner:

For the prism level, the body of which has a cloth finish, remove the object glass cap and run the eyepiece slide part way out as though focussing for a near-by object. Provide a Y of wood or metal large enough to fit over the object glass end of the telescope, where the cap usually fits. Take a second Y of a size suitable to inclose the eyepiece slide near the main telescope tube. Fasten these Y's securely in an upright position and rest the telescope in them, sight a distant point which the cross wires cut, revolve the telescope in the wyes and adjust the cross wires in the usual way. A final adjustment must be made for such instruments as this by the usual methods.

But prevention is always better than cure, and a great many instrument troubles may be prevented by care in handling the instruments and by the frequent application of a little oil (a very little will answer) to spindles, leveling screws, tangent screws and telescope slides. An occasional cleaning with an oily rag will work wonders. Never over strain a screw; make it snug and no more.

The workman who takes care of his tools, who learns to do good work with the means available, is not the man who fills his report with excuses. He knows it is results that are wanted, not excuses.

Government Tests of Lubricating Oils.

By A. B. Willits, U. S. N., in *Iron Age*.

The selecting of the best lubricating oils for the machinery of our naval vessels has become a momentous question during the past year, owing to the decision of the department to disapprove requisitions for special brands and in lieu thereof to purchase in open market entirely on specifications. For many years lard oil was the recognized standard, but with the advent of engines of greater power coincident with the development of a cheaper and better lubricant in the petroleum oils, lard oil with its unsavory odor and high cost became a back number, and a few particular brands of mineral oils were adopted with satisfactory results. The actual tests made by contractors during their official trials of the big vessels, where so much depended upon efficient lubrication, brought the excellence of these brands, which were carefully compounded for the particularly trying service, into such prominence as to practically give them the monopoly in the navy.

It was quickly discovered that there was a chance for competition in this field, offering a good return, and there soon came a demand for the privilege of bidding from every oil compounder, many of whom had little appreciation of the requirements. In admitting all, the only protection lay in specifying in detail such qualities as must characterize acceptable oils. Fortunately the experience with the special brands enabled the Bureau of Steam Engineering to formulate precise specifications, which would eliminate such oils as would have to be used in excessive amounts to keep the bearings efficient, or would endanger these bearings by failing to maintain an effective film under high speeds, pressures and temperatures.

To appreciate how important this is, take for instance an armored cruiser like the West Virginia or Pennsylvania, ships developing 23,000 indicated horse power, which at, say, 18 knots per hour, require about 200 gallons of best mineral oil per day for proper lubricatien. With a poorer grade the quantity must be increased, and the danger of hot bearings arises. The brasses for one main engine crank pin weigh 450 pounds and require about 100 pounds of Babbitt metal, and when this is overheated and burnt out by bad lubrication, it is no trifling job to disconnect and reline the boxes, while the time at which such crippling occurs might cause the defeat of a maneuver or the loss of a battle. It is natural and proper, therefore, that naval engineers should resent all movements toward loading up with any but excellent oils.

In March, 1905, specifications for lubricating oil for marine machinery were issued, embracing a frictional test on an oil testing machine, using a standard brass bearing of about 9 square inches projected area on a polished steel mandrel making about 160 revolutions per minute, in which test the limit of temperature was designated to be 130° F. The average load on the bearing during 2 hours' test must be at least 300 pounds per square inch of projected area, the quantity of oil necessary to prevent undue friction and higher rise of temperature being taken into account in the results, and the quotient, found by dividing the product of the average total pressure on the journal and surface speed of journal in feet per minute by the weight of oil in grains for lubrication during the 2 hours, not to fall below 325,000. The flashing point must not be below 400° F. Sufficient oil to cover the bottom of a shallow dish when heated to 250° F. and cooled slowly must exhibit no gummy residue. The oil must flow at a temperature of 32° F. A small quantity when applied to a polished copper plate must not turn the surface of the metal green if allowed to stand exposed to the air for 24 hours. The viscosity of the oil at 90° must be between 685 and 710 compared with distilled water (49) at 90° F. When tested in an Engler viscosimeter, using the same standard, the viscosity of the oil at 150° F. must be between 155 and 165, and at 225° F. between 75 and 85.

It was found that the greater number of failures consisted in unsatisfactory viscosity at the different temperatures, and this point alone is a most important guide in selecting good oil. Later experiments, however, proved that an additional gumming test was necessary to prevent the acceptance of unsatisfactory grades, and a special test has now been added, as follows: Using a single wick, ½ pint brass oil cup, and maintaining the oil at about 140° F., practically equal quantities of oil must feed through the wick in equal intervals of time, for 3 intervals of 8 hours each. At the end of the test the wick must be clean and the sides of the oil cup bright and clean.

The accompanying sketch, Fig. 1, shows the oil cup device arranged

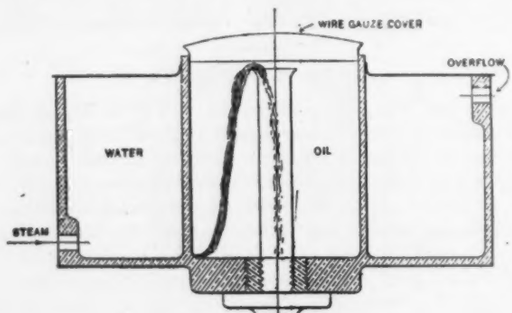


Fig. 1.—Device for Testing the Gumming Tendency of Oil.

for carrying out this gumming test. It is a single double cup casting, the outer part of which is kept filled with hot water, maintaining readily the temperature of the oil at about the required limit by adjusting the steam admission valve. Fig. 2 shows the arrangement complete for the test. The siphon pipe may be readily applied to one of the ordinary 5-gallon cans in which oil is now delivered for government use. This enables the haphazard selection of any can on a lot, and as it draws the oil from the bottom of the can its worst features are exposed if it contains a gummy sediment.

Where the continuous 3 periods of 8 hours each are not practicable, the test is stopped by closing the lower petcock on the oil cup, the steam blow-off valve and the oil admission valve in the siphon pipe, and continued on the following day without having disturbed the wick by first heating the oil by the water bath to the required temperature before opening the bottom drip cock. The height of oil in the oil cup is maintained between two marks on the inside of the cup to a fair height. The thermometer is kept in the oil, and the drip from the cup is caught in a 1 quart graduated glass, which, when filled to the quart mark, is

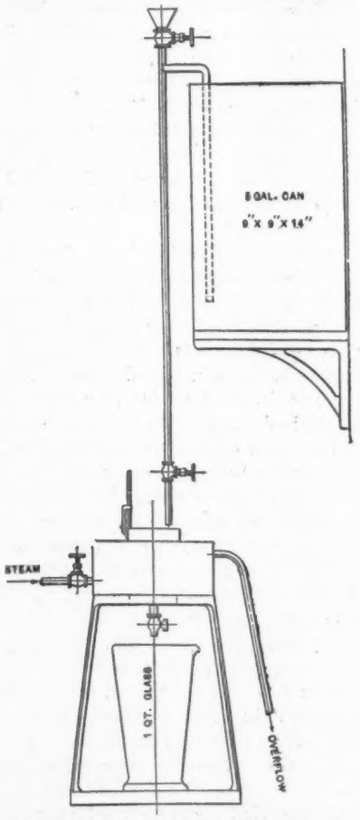


Fig. 2.—The Complete Apparatus for Making Gumming Tests.

replaced by an empty glass and record made, together with the fractional parts at the end of each 8-hour period.

Some manufacturers consider this test severe, but the best oils in use have successfully passed and practically filled the conditions required.

The Municipal Electric Plant, Cumberland, Md.

The *Electrical World* reports that a month or two ago considerable publicity was given in the newspapers to a dispatch from Cumberland, Md., stating that the cost of the municipal arc lighting plant there was only $34.06 per light per year, everything included, and then goes on to say: "We have obtained a copy of the report upon which this claim is based, but do not find anything in the figures to support it. As we are at a distance from the place, we have asked a central station manager in Maryland to discuss and analyze the report, which he does in the subjoined communication:"

The plant in question is working under very favorable conditions, but notwithstanding that, I can show a cost of nearly $60 per lamp. The plant was placed in a small building next to the water works, and by adding a few dollars to the water employees, and hiring an electrician and trimmer, they were ready for business as far as salaries were concerned. Taking their figures, which are absolutely approximated, except salaries, we have $7,879.01 for salaries and labor, fuel and supplies, $2,280,6 per cent. depreciation, interest on bonds $800, making a total of $10,859 01. Deducting $2,000, value of supplies on hand, the total cost was, $8,959.01, or $34.06 per lamp for 263 lamps. But the plant has cost the city $40,000, and the machinery is of the antiquated design, with four of the five arc machines belted to one 18 x 24 engine, which is overloaded. There is no reserve, which means that it will not be long before the demand is greater than the capacity of the plant, while breakdowns must be provided for.

In my figures 10 per cent. depreciation will be charged, although I think under the conditions 15 per cent. is nearer the truth, but I want to be as conservative as possible.

Cost of plant, $40,000.		
Salaries and labor	$3,333.58	
Fuel	2,280.00	
Supplies	8,536.53	
		$7,897.01
Depreciation, 10 per cent. on $40,000		4,000.00
Interest on bonds and appropriation 6 per cent., $40,000		$2,400.00
Additional fuel		366 40
Labor not considered		300.00
Oil, waste and packing		250.00
Lamp renewals		600.00
Repairs, engine and boilers		250.00
		$16,063.41
Deduct actual value supplies on hand		495.50
Total maintenance		$15,564.91

This amount divided by 263 lamps gives $59.10 per lamp per year.

In order to show the unwisdom of the city of Cumberland in going into the electric lighting business, when a company already formed and doing business stood ready to furnish lights as cheap as and in the long run cheaper than the city, even under favorable conditions; and also, because the information may be useful to other municipalities, that may have this subject under consideration—I take the liberty of submitting a history of the Edison and the municipal plants.

The Edison company began operation in 1884, and from the beginning lighted the streets and alleys, and all public buildings with incandescent lights. The original charge for street lighting, all night and every night in the year, was $10.80 for 10-candle power lamps, and $12 for 13-candle power lamps. Later all lights were changed to 16-candle power lamps at $12 per year. About 1891 the Council asked for a few arc lamps, and the company installed a Westinghouse 2,000-candle power, 10-amp. arc system with the understanding that after arc lights were once available, the city would gradually replace the incandescent lights with arcs.

When the company first started the arc system there were about five or six arc lamps on the circuit, and after about two years the number had grown to about a dozen. At this point it dropped the price from $100 to $91 per year per lamp. The city added a few lights each year, and at the end of 13 years the company were furnishing the city only 27 lights, and so scattered that it required nearly 30 miles of wire to reach the lights. At this time the street lighting consisted of about 400 incandescent and 27 arc lamps, at a yearly cost of less than $7,500 per annum.

It is true the streets at that time were not as brilliantly lighted as at present, except where the arc lights were placed, but the 400 incandescent lamps covered all alleys, dark spots and holes in the city, impossible to reach with arc lights alone. Do not infer that I consider incandescent street lighting superior to arc street lighting. I bring this part of the history up merely to show that while the streets to-day are more brilliantly lighted under the present system, yet there are many dark alleys and holes to-day, that were formerly lighted with a 16-candle power lamp, while it is costing the city 100 per cent. more than when they were buying the service. If the city had accepted the price of $60 per year for arc lights, which was made to the committee appointed by the council to build the addition to the water works for the electric light plant, the city would be as well off financially, and considerably better off as far as distribution is concerned, and at a considerably less cost per year.

In the first place 175 arc lights properly placed would be sufficient, and at a cost of $60 per year would amount to $10,500 and 100 incandescent lights at $12 per year would make 275 lights at a cost of $11,700 per annum. Many of the city arc lights are erected at places where a 16-candle power lamp would be satisfactory, and many dark holes, such as under shade trees, etc., that have no lights could be lighted to the satisfaction of the people, at a cost of $12 per year, so, 175 arc and 100 incandescent lights properly placed would give a better distribution than the present system, with a saving to the taxpayers of $4,000 per annum, and relief from the present antiquated plant. The problem is whether to add to the present junk pile, or throw it out, and spend $50,000 for a plant that will be adequate to supply the demand.

In 1897 a number of citizens thought the street lighting was costing too much and agitated for a municipal plant. As usual the cry struck a popular chord, as a cost of $35 per light was promised, and the plant was to cost only $20,000. The question was put to a vote of the people and was carried by a large majority. Accordingly plans were drawn and bids asked for, but later were withdrawn, as no bids came within the amount of bond issue of $20,000.

The next move on the part of the citizens was to cheapen the plans so as to come under the $20,000 appropriation. In the meantime the company offered to furnish arc lights at $60, and tried to show the committee that $20,000 would not build the proper plant, and in fact the manager is on record as saying that if the city was bound to build

the plant, they had better spend $40,000 and build a plant that would not have to be thrown out in a year or two. A construction company undertook to build the plant on the new plans, and after placing all the poles so that all the trees in the city came in contact with the wires, and placing 50 per cent. of the poles 2 feet in the ground instead of 6 feet, it broke up before the plant was completed.

The plant was finally placed in operation in September, 1898, and from the very first night was overloaded. They ran along for several years adding lights until the engine was unable to pull the load, and it was necessary to do something. Advice was asked and I made a suggestion, and a rough idea of what was best to be done under the circumstances, and also advised them to secure the services of an efficient electrical engineer—which they did. The engineer, a capable man, looked the plant over thoroughly, and later submitted a report advising just about what I had suggested, viz., throwing out the original plant, and placing proper and up-to-date machinery, capable of not only caring for the present, but for the future, as well as making provision for the lighting of the city buildings.

The Management of Small Central Stations.

By Mr. Henry Joseph, in *Elec. Review.*

Almost ever since electricity has been supplied from central generating stations the efforts of central station engineers have been directed towards the attainment of a high load factor as an element in the cheapening of the cost of production. As a means to this end every effort has been, and is being, made to increase the day load by advocating the use of motors, heating apparatus, etc. In large towns, where the load is sufficient to justify a day shift, there can be no doubt that this course is a wise one, and that current in such cases can very well be sold for use in the daytime at a price very considerably less than that charged for night consumption. But when we come to consider individual cases of small towns or villages, where, either from their purely residential character or their small size and limits of ultimate expansion, a large day load is out of the question, it is quite a debatable point whether it is advisable to encourage a day load at all, especially if, in order to do so, the rates for such purposes as have been indicated are to be materially reduced.

There are, in fact, many problems in central station management which bear an entirely different aspect in a very small undertaking to what they do in a large or moderately large one. What is true for a fair sized but growing town with an industrial population is not by any means necessarily correct for a small town of under 10,000 inhabitants with a residential population, and no apparent prospects of any very rapid expansion. In such a case it is very unlikely that the day load will for many years be sufficient to economically load the smallest set; and, consequently, the current used in the daytime has to be supplied from a battery, which practically means an extra loss from charge to discharge of 25 per cent., or a loss equal to 33⅓ per cent. of the units sold. Probably little or no labor is entailed in the generation of these extra units, so the extra cost is not quite so great as it would at first sight appear, but under these conditions it does not seem to be commercially sound to sell current in the daytime at a reduced price. In an alternating current station this argument does not, of course, apply (unless a motor-alternator is combined with a battery), and in this case the day load, though more difficult to obtain, is essential to anything like economical running. There are, of course, many continuous current stations of small size that have for years been trying to increase their day load by means of cheap rates, but few indeed of the really small ones have started a day shift. So long as there is an ultimate prospect of this being attained, it is perfectly justifiable to hasten matters by reducing the power rates even if for the first few years the result is not remunerative. But where from the very nature of things the day load must ever bear a small proportion to the evening load, it appears to be the best policy to look facts in the face and charge a uniform rate for light and power.

In one or two small towns where no appreciable day load is anticipated, a small oil or gas driven set of from 4 to 10-horse power is installed in place of a battery, so as to save the capital cost as well as the heavy depreciation of the latter. This system, though inefficient, certainly recommends itself, as it does not entail stand-by losses or the cost of attendance.

There is a tendency with central station engineers, as with people in every branch of industry to follow one another like a flock of sheep. Once a certain lead has been given by one man and adopted by a few others, the rest follow as a matter of course without appearing to consider whether their case is similar to those of the few pioneers, and so electricity supply schemes come to be carried out on stereotyped lines, as if the system which is applicable to Liverpool were equally suitable in all its details to Muggleton-on-the-Mud.

A good example of this kind of thing is the adoption of the maximum demand system. One man comes along with a demand indicator in the hope that he will flatten out the peak of his load, and also with the conscientious desire to charge his various consumers in proportion to the cost of supplying them.

The system, no doubt perfect in theory, impresses itself on other engineers, and is finally adopted by stations all over the country, in many of which the capital cost and clerical work involved are out of all proportion to the advantages ever likely to result from its adoption. The maximum demand system is a bad one, inasmuch as the average consumer can never be brought to understand its working, and many fight shy of adopting electric light for fear they should be charged at the higher rate. Indeed, everything points to its being finally superseded by a flat rate with a sliding scale favoring large consumers.

The system of charging at a reduced rate for heating and power purposes irrespective of the hour at which the demand is made, also seems to be unsound, and the case is being met in some places by the use of double tariff meters controlled by time switches. This system seems to be very sound in theory, but it remains to be proved whether the extra capital cost is justified by the advantages gained. One of these is the tendency to prevent the overlapping of the lighting and power loads. If this were its only merit the system would certainly not pay for itself, but it also has one very great point in its favor.

If the cheaper rate is sufficiently low, the consumer can very well afford to be extravagant in his daylight consumption, and will not hesitate to make what use he can of his supply as long as the meter is only registering cheap units. Hence it encourages the use of apparatus which otherwise would not be used at all, and what most of all is needed in a station of moderate size, it results in a long-hour day load.

A long-hour demand at any time is, of course, much to be desired, whether in the daytime or in the evening or night, and for this reason street lighting is a most valuable asset both for large and small stations. In small towns it is not usual to keep the public lamps alight after midnight, hence this load will mostly be supplied direct from the generators.

The selection of a suitable consumers' meter is a problem that requires very careful consideration. It is difficult to find a meter which, while cheap, is also accurate and reliable. There is a very considerable difference between the cost of the cheapest and the most expensive meter, and this difference in the aggregate represents a capital expenditure which cannot be treated lightly. Are the advantages of the expensive meters sufficient to justify this extra cost? The principal advantages which one expects to find are: (1) Accuracy, or in other words, the assurance that the consumer will not be paying for less current than he consumes; (2) reliability, freedom from breakdown, with its resultant necessity for more or less frequent replacements and repairs; (3) low consumption of energy; (4) low starting current. Only careful trials of different meters can settle the question at issue. One of the faults which most motor meters develop is a tendency to run slow after they have been in use for a considerable time, and this defect, which is likely to result in a very considerable loss, is one that is by no means restricted to the cheaper variety. There are meters on the market which show the reading in units direct, thus preventing the possibility of error on the part of the inspector.

Confusion is very liable to arise in reading the old-fashioned dial meters, and it seems a pity that the former system is not universally adopted. It really seems as if a meter which is fairly accurate and not too liable to be upset by careless handling is after all what is most needed, especially on small systems, where most of the consumers are small ones. And if such a meter can be obtained at a price considerably lower than that of one of greater accuracy and lower energy consumption, the saving is in most cases justifiable. The other extreme has, of course, to be guarded against, for a meter, though low in first cost, may entail an amount of labor in replacing, overhauling and re-testing that will make it the dearest in the long run.

In most small towns a good deal of attention is given to the prepayment system. It is usual to wire small houses up to 10 or 12 lights free of charge, the slot meter being arranged so as to charge the consumer about 25 per cent. more than the ordinary rate, in lieu of paying for the hire of the meter and installation. This system has in many places been fairly successful, but things have to be cut very fine all the same to make it pay, and the cost of the meter is often nearly as much as tha

of the installation. Most prepayment meters are very liable to get out of order either through careless use or bent coins being used, or through some inherent defect in an over-complicated mechanism. A really good and reliable slot meter at a reasonably low figure has yet to be found.

If all the costs incurred in connection with a prepayment system were properly allocated, very few towns, in the opinion of the writer, could show much of a margin on this class of consumer. Frequent attention is necessary either from defects in the meters or from those sudden and unaccountable and altogether too frequent changes of tenancy which seem inseparable from the poorest class of consumer. One of the advantages of the prepayment system is that the clerical costs are reduced to a minimum, and if special efforts were made to lower the capital charges, there is no reason why there should not be a considerable profit on slot consumers in spite of the inherent disadvantages already referred to. One essential is the reduction of mains costs by putting a block of cottages on one service.

If every house is to have a separate service, especially if this entails a road crossing, the system cannot be expected to pay. The writer puts a service in the center of a block of from 4 to 6 cottages, and loops from cut-out to cut-out on the bus-bar system by means of interior wiring, the wires passing through the party walls in insulated tubes. One objection to such a plan is that the fuse may blow in the service cut-out, when the tenant in whose house it is fixed is away for a long holiday with the key in his pocket This possibility is somewhat remote, especially if good, heavy service fuses are used, but it would certainly place the supply authority in a very awkward position if the other 5 houses had to wait for their light until the holiday maker had returned, or the key of the house had been obtained. This possibility could be removed by fusing the block in a cheap inspection box just outside the center house, but the probability is that liberal compensation in such an eventuality would be cheaper than taking elaborate, and perhaps expensive, precautions to obviate it. Some engineers, who are wantonly extravagant in services for small consumers, choke off many really good ones by making a charge for all cable laid over and above the 60-foot limit. Except in extreme cases, it is the greatest folly to make this charge, for, although the particular consumer may not object to pay, it has a very serious deterrent effect on others who are contemplating taking a supply. Everything should be done to reduce the initial outlay of the would-be consumer to a minimum, as it is often on this ground, rather than from any fear as to the cost of current, that a man will shrink from adopting electric light.

The free wiring system has for this reason been the means of greatly extending the business of many electricity supply undertakings. A fairly common system is to charge the consumer with a rental equivalent to 5 per cent., or 7½ per cent. on the initial outlay. If the latter figure is adopted, a sufficient return is assured to pay interest and depreciation on the installation. The wiring is either done by the company or by local contractors who, having canvassed the consumers, are given the order to wire the houses on behalf of the company. This acts as an incentive to the local firms to thoroughly canvass the district. The same plan is adopted for slot consumers. To get over the disadvantage of the heavy capital cost of slot meters, it has been suggested that small cottages should be wired free with, say, 7 lights each, and supplied in blocks of half a dozen or more in a row, off one service. The cottagers would be charged a fixed sum varying from 6d. a week in the summer months to 1s. a week in the winter, and would be allowed to use as much current as they pleased up to a certain limit. A meter would be fixed which would show the consumption of each block, and if at any time this meter showed that wasteful use was being made of the supply, the culprit would be localized by fixing a meter in each house. The offender would then be liable to be disconnected. Where this system has been tried, it has failed, for two reasons—firstly, the current consumption was excessive, the consumers being unnecessarily extravagant; and secondly, it produced a feeling of discontent among the consumers on the slot system, who were paying as much or more and getting less light.

The question of canvassing is one that is not always given the amount of attention it deserves. Where the undertaking is too small to pay for the services of a canvasser, the best plan is to encourage by every available means any wiring contractors that are willing to do this work, even though the result may be to bring the said contractors into competition with the company's wiring department. By the exercise of a little tact any tendency to unpleasantness can be avoided, and it is often wise in certain cases for the company to retire and leave the field free to the contractors. It is, after all, a matter of secondary importance whether the wiring department makes a small profit or merely pays its way. By adopting the free wiring system and subletting the installations, a whip hand is kept over the local wiring firms, and it is possible by these means to force them to adopt certain standards laid down by the company, such as the exclusive use of lamps of two or three of the best makers, both for free wiring and cash installations. Where a canvasser is kept, or where there is a man who can be spared from his ordinary work for a few hours a week, the canvassing should be done on a systematic plan. It should be borne in mind that consumers show the same sheep-like tendencies as central station engineers, and once a start has been made in a particular road, it is often a comparatively easy matter to induce others in the same neighborhood to take a supply.

In conclusion, the writer would urge the necessity of keeping all capital costs as low as possible on small systems. Large systems with numbers of big consumers packed closely together all along their mains can afford to adopt extravagant means to safeguard the supply and maintain a steady pressure, and many fads can be indulged in inside the station to facilitate the working of the system, but in small undertakings, with mostly small consumers more or less scattered about, it is necessary to do everything in the cheapest possible manner consistent with economy and sound engineering.

The writer looks forward to the time when overhead wires will be more generally used for supplying scattered districts, thus rendering a cheap supply possible where it is now prevented by the prohibitive cost of underground mains.

Naphthaline at Sheffield.[1]

By Mr. Hanbury Thomas.

In the *Journal* for Dec. 19 reference was made to the processes of Mr. J. Ferguson Bell and Mr. Alfred Colson having been tried at the works of the Sheffield United Gas Light Company—Mr. Colson's at Effingham street, and Mr. Bell's at Neepsend and Grimesthorpe. Both these processes were experimented with in 1904; but the results then obtained were not so satisfactory as they have been during the past year. In fact, so far as Mr. Colson's process is concerned, no benefit was derived from it whatever, and the opinion of Mr. Colson, and of the Company's Engineer (Mr. J. W. Morrison) was that the cause of its failure was due to its not having been started until late in the season (Aug. 11) when a considerable deposit of napthaline was in the mains. Last year (1905) it was decided to commence both processes in April, before naphthaline had made its appearance in the districts; and the following figures will show the advantage that has been derived:

Table A.—*Number of Naphthaline Complaints Attended to from April 1* to Dec. 31, for the years 1901 to 1905.*

	1901.	1902.	1903.	1904.	1905.	Number Meters in each District June 30, 1905.
Neepsend	13,675	1,445	3,927	1,041	101	33,437
Effingham street	4,534	882	653	1,646	34	14,053
Grimesthorpe	374	302	682	1,163	17	9,140
Arundel street	2,070	678	1,642	1,426	67	11,196
Granville Hill	4,738	1,255	1,912	2,164	73	3,382
Shude Hill	1,009	262	444	632	31	7,503
Total for Company's entire district	26,400	4,824	9,260	8,072	323	78,711

* Leicester process started at Effingham street, April 10; Derby process started at Neepsend and Grimesthrope, April 13, 1903.

The areas supplied from Arundel Street, Granville Hill and Shude Hill obtain their gas from both the Neepsend and Grimesthorpe works. It is delivered to governors at a high pressure, and distributed therefrom into the districts.

Mr. Bell's process was adopted for the Neepsend and Grimesthrope stations, on account of the more favorable results shown at Neepsend, where if was tried in 1904; only last year there was a difference, which possibly accounted for the diminution of complaints in that district. In 1904, in addition to the solvent, the hot gas was washed with tar; and in 1905 the solvent only was used—Mr. Bell holding the opinion that, the Sheffield Company's gas being of a higher illuminating power, and showing by the Colman test less naphthaline than that supplied at Derby, the tar washing was rather detrimental than otherwise. As regards effectiveness, there does not appear to be much to choose between the two systems, as, though the Neepsend figures show a rather larger proportion of complaints to the number of consumers than Effingham street, the Grimesthorpe figures are more favorable to

1. *Journal of Gas Lighting.*

the Derby process. There has been only one complaint during the last three weeks; and the treatments have consequently been discontinued at Neepsend and Effingham street.

Prior to the year 1887 naphthaline had never been seen in Sheffield. It may be remembered that the summer of that year (the Queen's first Jubilee) was an extremely hot and dry one. When the company were first troubled with it, Sir Frederick Mappin, the Chairman, took the matter up, and has ever since given it his most earnest attention—having insisted from the very beginning that there must be a remedy, and that it ought to be, and eventually would be, found. The above figures, and the experience at Derby and Leicester, seem to prove that he was right, though most authorities had come to look upon naphthaline as an evil which while it admitted of mitigation, had to be put up with. Readers of the *Journal* will be aware that Sir Frederick has never failed for many years at the various meetings of the company to draw attention to this subject; and he has spent a very large amount of time in consultation with the company's officials, as to the method of working and measures to be employed, with a view to overcoming the difficulty. The company's engineers have visited many works in the kingdom, both where naphthaline was experienced and also where there was freedom from it, and numerous plans have been tried. The following table shows the number of complaints, etc., each year since 1887:

TABLE B.

Year.	No. of Meters in Use.	No. of Naphthaline Stoppages Attended to.	Gas Made per Ton of Coal Carbonized. Cubic Feet.	Average Quality of Gas Supplied During the Twelve Months.
1887.....	44,147	1,230	9,849	17.76
1888	45,520	535	10,127	17.61
1889.....	47,231	1,693	10,124	17.56
1890.....	48,372	5,073	10,244	17.52
1891.....	49,523	577	10,406	17.52
1892.....	50,468	227	10,071	17.40
1893.....	50,818	524	10,217	17.51
1894.....	50,945	485	10,346	17.92
1895.....	52,320	953	10,425	18.00
1896.....	54,155	410	10,430	17.73
1897.....	55,709	871	10,355	17.77
1898.....	58,503	5,530	10,149	17.84
1899.....	61,459	20,229	10,276	17.50
1900.....	64,758	15,399	10,298	17.41
1901.....	67,950	28,181	10,278	17.34
1902	71,392	5,597	10,366	17.41
1903.....	74,815	9,664	10,363	17.37
1904.....	77,681	8,787	10,419	17.36
1905.....	81,894	532	10,506*	17.37

*The make of gas for 1905 is to June 30; that for the half year to Dec. 31 cannot yet be ascertained.

In the year that naphthaline first appeared, no alteration whatever had been made in the method of carbonizing over that of previous seasons. In fact, everything was the same as it had been for many years before. The make of gas was only 9,849 cubic feet per ton of coal carbonized, and regenerative furnaces were not started until 1890, and then only to a small extent. They have, however, since been adopted at all the stations. Stoking machinery was first installed in one retort house at Neepsend in 1891.

It does not appear that the make of gas has any direct bearing on the question, as reference to the table shows that in 1891, when 10,406 cubic feet of gas was made per ton, there were only 577 complaints. Again, in 1896, with a make of 10,430 cubic feet, there were only 410 complaints; whereas in 1899, when the same class of coal was used, and the make was only 10,276 cubic feet, there were 20,229 complaints, and in 1901, with a make of 10,278 cubic feet, 28,198 complaints. The quality of the gas in these years did not vary greatly; being 17.52 candles in 1891, 17.73 candles in 1896, 17.50 candles in 1899, and 17.34 candles in 1901. In this connection, Mr. Colson made a very interesting experiment. For a considerable period in 1901 and 1902, he worked with 7-hour charges and low retort temperatures, without experiencing any relief; and in October, 1902, when he reverted to 6 and 5-hour charges, high heats, and big yield of gas, he actually found his complaints were less numerous. In a letter to me he said: "Whether the improvement is to be attributed to this cause, I am not yet quite sure; but we are doing very well—much better than last year, when working 7-hour charges and lower temperature. I have made no other change."

Many remedies have been tried, among others the boarding-up of the condensers; it being considered that the effect of the sun on them was detrimental. A large extension of foul mains was made, in order to give the gas a longer travel inside the retort house, so that very gradual condensation might take place before it reached the condensers outside, and additional water-cooled condensers were erected. A point that was almost universally recommended was that the temperature of the gas at the outlet of the condensers should not exceed 60°. This was tried from February, 1899, till November, 1901, when it was decided to test the effect of higher temperatures; it being considered that, in reducing the temperature so low, various solvents which might, if allowed to travel with the gas through the mains, prevent deposits, were condensed out of it. This proved to be to a great extent correct, as the following year (1902) the complaints fell to 5,597—whereas in 1901 they were 28,189—and have never since reached the high numbers that obtained when condensation to low temperatures was in vogue. Prior to the year 1899, no particular attention was paid to the outlet temperatures, which were allowed to rise and fall with that of the atmosphere.

It was formerly considered that naphthaline was deposited in the mains in the winter months, and carried forward to the consumers' services in the summer. This idea is not borne out by experience at Sheffield, as for several years' examinations made of a number of trunk and other mains showed no signs of it until early summer, when crystals were noticed on their interiors. These mains have been subjected to monthly inspection; and it has been found that all traces disappeared in the winter. Moreover, the complaints have always diminished during the later months of the year, have disappeared altogether in the early spring, and have not again broken out in any number until the following summer. An outburst of hot weather was then sure to augment them considerably; and they would thereafter be prevalent for the rest of the season—showing increases with sudden variations of temperature either for hot or cold. The officials of the company during the past year enjoyed such peace of mind as has not been known to them for a very long period, and they look forward with hope to being spared the anxiety and never ceasing worry they have been accustomed to endure for many years.

As has been previously announced in the *Journal*, the directors of the company are much gratified with the great improvement that has been effected, and at the last meeting of the Board they decided that some acknowledgment was due to both Mr. Bell and Mr. Colson for the intelligence they had displayed in working out a most difficult problem, and for placing the results of their exertions at the company's disposal. It has been the custom of the company for some years past to send to both Mr. Colson and Mr. Bell a monthly account of the number of naphthaline complaints dealt with, and they have supplied the same information to Sheffield. Notes of what was being done at the works of each to overcome the difficulty, have also been freely exchanged.

New Uses for Electricity.

A contemporary remarks that there are many ways not yet thought of for pushing business. One of these was recently developed by the manager of an electric central station, which has cheap water power. The "load" of his house lagged superfluous at some periods of the day, and thus the earning capacity of his plant was far below the figure that an up-to-date manager can contemplate without uneasiness. He bethought himself that there were in his locality quite a number of ladies who had nothing much besides social functions with which to occupy their time. He had several sets of electric utensils, including ovens, chafing dishes, tea and coffee urns, waffle toasters and other handy appliances ordered, and these he distributed among the different families, asking that they be used, and promising the current with which to operate them free. Electric teas promptly became the vogue, and the acquaintances of those who were the lucky possessors of electrical outfits began to inquire where the utensils could be had. At this juncture the manager, who had been patiently awaiting it, intimated to his friends that he would be pleased to give a commission on all orders that came through the demonstration of the qualities of the missionary electrical outfits. A boom set in, and before long almost every house in the neighborhood was reveling in the luxury of electrical cooking, and the station has no longer to wait until dusk sets in to sell current.

A recently introduced use of electricity is the electrical hardening of high speed tool steels. The tool to be hardened is held in a clip, and, current being turned on, is lowered into a strong solution of potassium carbonate. The act of dipping the tool into the alkaline solution completes the electrical current, and at once sets up an intense heat in the immersed part. When the tool is sufficiently heated the current is switched off; the solution then chills and hardens the point of the tool

rapidly, so that no air blast is necessary. In many hollow tools made of high-grade steel it is necessary that the outside or cutting portion shall be hard, while the interior is soft and tenacious, so as to be in the best condition to resist the great stresses put upon the tool by the resistance of the metal being cut. Formerly a heated rod was inserted within the tool to draw the temper, but this often produced a cracking of the metal, and it was difficult to raise and lower the temperrture or maintain it at any required degree until the proper temper was obtained. Now the rod is placed inside the tool quite cold, and the electric current gradually and steadily heats it until the correct temperature is reached. This is evenly maintained until the tool is tempered.

A new style of electric automobile, which is adapted to all classes of farm work, has been brought out. It may be equipped with a reaper or with a cultivating device, which prepares the ground and sows the seed at one operation. It will plow 6 or 7 acres a day at a cost, including interest, depreciation, fuel and labor, of $1 an acre, less than half the cost of plowing by horse. When not needed for field work it may be used for driving any kind of farm machinery.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Some Thoughts on New Business.

THE PUEBLO GAS AND FUEL COMPANY,
PUEBLO, COL., Jan. 24th, 1906.

To the Editors of the AMERICAN GAS LIGHT JOURNAL:

New business is the interpretation of all commercial activity, either in a small local sphere that can be traced from a gas company operating in a community of 5,000 people, or until it broadens out to insure national prosperity. It causes to be produced most all inventions, sharpens the intellect of man, and has caused wars between nations.

Men who are unable to increase their business from year to year could not be considered successful business promoters. The man who can satisfactorily retain all old business and keep adding to the total day by day cannot be refused a reserved seat in the temple of success. My idea of reaching this point comes under three classifications: Perseverance, modern methods and honesty; perseverance, that we should never give up; keep hammering away and everything is possible; modern methods, that we should always keep pace with progressive improvements; honesty in representation to consumers.

There is no pardonable excuse for any gas man to misinform or willfully make the wrong impression upon a prospective gas consumer, for nothing that could be said by the most enthusiastic representative would in any way exaggerate the high qualifications of the economical, ever-ready, modern gas range or gas lamp. It is not a question of meeting competition with salesmen and solicitors of superior ability who can out-talk the consumer and sell him something he does not want. It is a case of education; therefore the gas man can't lie, for he has no reason to.

Any kind of advertising helps, no matter in what form, as long as it is confined to intelligent business principles. You cannot compel the people to read your newspaper, advertising circulars or bill board posters, but any wideawake solicitor who has an ounce of ginger in him should have no trouble in educating 95 per cent. of the people in his territory that gas is made for all the people to burn for both light and fuel, that every consumer is a stockholder of the company, their dividends being represented by economy, convenience, quality and the satisfaction that they have second to none, but superior to all others.

Less than a century ago people had only candles for illumination and the cooking was done upon the fireplace. Coal oil with the cook stove was then introduced and the people slowly became aware what a wonderful improvement had been attained. Next came the gas range and light which likewise won an overwhelming success for gas, although there are a few who are still living in the dark, and only require the efforts of an active "new business department" to bring them into the true light.

When the inventor completed the gas range he blocked his path of progress. He cannot get by, crawl under or jump over. He then invented the improved gas lamp, the only imitation of the great light of day. The best advertisement is the goods. Get a range and light into a house, then it is an easy matter to convince all surrounding neighbors that they should have the same thing. The gas business is an enterprise that would advance and grow without any effort upon the part of the company.

Solicitors and advertisers push the thing along faster. The manager of the new business should keep close tab on all solicitors and assist and encourage them in every way. Keep down all friction and have them work as a body, each in his own territory, but ever ready to help one another; also ward off all dead beats seeking light. Some men work better and produce more business on a commission; others give better satisfaction when paid a salary. No fixed rule can be adopted; all depends upon the man in the field. The canvassing of old consumers is just as important as are efforts to secure new business. Keep their troubles all doctored up, either real or imaginary. While competitors are selling only an imitation of light the gas man should be able to sell the real thing.

Work on the lighting business 12 months in the year, and on ranges and appliances 365 days. Yours truly, D. S. GREENWOOD.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. HAZEN S. CAPRON reports the transfer of the properties and rights of the Princeton (Ills.) Gas Works to Mr. George F. Duncan, of Portland, Me. Mr. Duncan is a member of the McKinley syndicate, which concern is well known in gas circles in the West. Capt. F. C. Duncan, of Galesburg, Ills., assumed active charge of the Princeton plant the 1st inst.

THE Gas Machinery Company, of Cleveland, O., will erect a 48-inch ammonia concentrator of its standard design on the plant of the St. Paul (Minn.) Gas Light Company.

MR W. A. ALDRICH, General Manager of the Spokane Falls (Wash.) Gas Light Company, writing to us under date of the 20th ult., notes that he will sever his connection with the Company at the end of the month, after exactly 11 years of service, to accept an engagement with the C. H. Geist Company, of Philadelphia. Entering the service of the Spokane Company, February 1st, 1895, the corporation had then 798 meters in use and 364 gas stoves were hooked up; the gas sold during the month amounted to 1,094,800 cubic feet, and the total receipts for the month were $2,930. On January 1st, 1906, they had 3,800 consumers, and 2,457 gas ranges in use, and on the lists were 876 gas arcs. The gas consumed during the month amounted to 7,974,600 cubic feet. In 1895 the selling rate was $2.50 per 1,000 cubic feet; to-day it is $1.50 per 1,000, with a lively prospect of a reduction in the near future. In 1895 the main mileage did not exceed 7 miles; in 1906 the mileage is 45. In 1900 the capacity of the works was doubled, and a year ago a new plant of the most approved modern style, with labor saving appliances put in wherever these were possible, was put in, giving the Company no trouble whatever to furnish the residents with 250,000 cubic feet per diem.

MR. ALDRICH is now in charge of the Pulaski Gas Light Company, of Little Rock, Ark., as its Vice-President and General Manager.

AT the annual meeting of the Grand Rapids (Mich.) Gas Light Company the officers chosen were: Directors, Emerson McMillin, L. J. Rindge, Henry Idema, W. H. Anderson, Irvin Butterworth, James M. Barnett, J. Boyd Pantlind, T. J. O'Brien and Henry Sullivan; President and General Manager, Irvin Butterworth; Vice-President, Emerson McMillin; Secretary, Glenn R. Chamberlain; Treasurer, Miss M. E. Kearney.

COL. FRANK S. RICHARDSON, Vice-President and Treasurer of the North Adams (Mass.) Gas Light Company, wants to extend its business ramifications to the outlying districts of Monroe, Florida and Savoy.

AT the annual meeting of the Pittsfield (N. H.) Gas Company the officers elected were: Directors, Chas. H. Carpenter, Hiram A. Tuttle, Sherburne J. Winslow, Charles H. Lane, Chas. M. Bailey, Clarence E. Barry and Nathaniel S. Drake; President, Charles H. Carpenter; Clerk, Nathaniel S. Drake; Treasurer, H. B. Fischer; Superintendent, Nathaniel M. Batchelder.

AFTER March 1st the selling rate at Nashua, N. H., will be put at $1.30 per 1,000 cubic feet, a concession of 10 cents.

MR. BERNARD CAHN, for many years prominently identified with the Consolidated Gas Company, of Baltimore, Md., died at his home in that city, the night of January 24th. He was in his 71st year.

At the annual meeting of the City Gas Company, of Norfolk, Va., the officers elected were: President, R. Lancaster Williams; Vice-President and General Manager, E. C. Hathaway; General Counsel, Wm. H. White; Treasurer, W. J. Kehl; Secretary and Assistant Manager, F. H. Sawyer.

Mr. William Clauss, Secretary of the Cincinnati (O.) Gas and Electric Company, has notified the shareholders that a special meeting will be held on the 26th inst., for the purpose of taking final action on the proposition to increase the Company's stock from $31,000,000 to $36,000,000.

The annual report to the shareholders in the Cambridge (Mass.) Gas Light Company showed that the output for 1905 was in excess of that for 1904 to a quantity slightly exceeding 17,000,000 cubic feet. The shareholders voted that the annual meetings shall be held on the third Tuesday in October, instead of on the third Tuesday of January, as was the former practice.

Mr. D. F. Brown, Manager of the gas range division of the Rathbone-Sard Stove Foundry, of Albany, N. Y., reports that the advance orders so far booked for gas ranges this season are away beyond the Company's best expectations. The same, however, may be said of the trade in general.

The Gas Machinery Company, of Cleveland, O., has been awarded the contract for the new coal gas apparatus, including an ammonia concentrator that is to be erected by the Cedar Rapids (Ia.) Gas Light Company. The generating plant is to be up to the supplying of 1,000,000 cubic feet per diem.

The capital stock of the Beloit (Wis.) Water, Gas and Electric Company has been fixed at $600,000.

The Springfield (Mass.) Gas Light Company is arranging to extend its main system across the river from Indian Orchard to and through the village of Ludlow.

The authorities of Duluth, Minn., have at last given practical ear to Manager Case's appeal for a new storage holder. The capacity of the vessel is put at 500,000 cubic feet. The Duluth gas supply is maintained on municipal account.

Mr. J. B. Dawson, of Boston, and his associates, have applied to the authorities of Winooski, Vt., for the right to there construct and operate a gas plant.

At the annual meeting of the shareholders in the Galveston (Tex.) Gas Company the Directors elected were: J. H. Hutchings, John C. Walker, Henry J. Runge, John Sealy and R. W. Smith.

The proprietors of the Waco (Tex.) Gas Company have awakened to the fact that the time is at hand to expend some money on plant improvement. The main betterments at present underway are on quite an extensive scale.

At the annual meeting of the shareholders in the Cambridge (Mass.) Gas Light Company the officers chosen were: Directors, Willard A. Bullard, Daniel G. Tyler, Henry C. Rand, Stanley B. Hildreth, Henry Endicott, George A. Sawyer and Arthur C. Whitney; Clerk and Treasurer, Albert M. Barnes.

The proprietors of the Lawrence (Mass.) Gas Company have declared the customary dividend of 3 per cent. for the 6 months ended the 1st inst.

At the annual meeting of the shareholders in the Doylestown (Pa.) Gas Company the officers elected were: Directors, John Yardley, Wm. H. Kirk, H. B. Eastburn, John P. Stillwell, Irvin Schutz, E. W. Keeler, J. F. Hendricks, F. L. Worthington and H. R. Graff; President, H. B. Eastburn.

At the annual meeting of the Portland (Me.) Gas Light Company, which was held the afternoon of January 24th, the retiring Board of Directors was re-elected. Mr. E. H. Daveis, who for so many years has successfully controlled the Company as its chief executive, declined a re-election to the Presidency. The Directors elected the following staff officers: President, Col. Fred. N. Dow; Vice-President, W. H. Moulton; Superintendent and Engineer, E. H. Yorke; Treasurer and Clerk, Burton Smart. The annual reports showed that the Company had enjoyed a most prosperous year, the percentage gain in output having been not far from 10 per cent. The terms of the new bond issue were agreed to.

The Directors of the Portland (Me.) Company unanimously adopted the following resolutions pursuant to the declination of Mr. Daveis to accept a re-election to the Presidency:

"The clerk is hereby directed to record in the records of this Board that the Directors recognize in the declination of Mr. Edward H. Daveis to serve the Company longer as its President, the closing of an official service unique im its length, unexcelled in its efficiency and rarely, if ever, surpassed in its satisfactory results by similar service rendered anywhere by anyone.

"Mr. Daveis was made President of this Company in 1860, and by annual re-elections has retained the office since that date. In all these years he has unreservedly given with great interest and zeal his unquestioned integrity, his sound judgment and his great business capacity to the service of the Company. During all this time he has commanded the respect and esteem of his associates upon the Board, and the confidence of the community, with which, as President of this Company, he has necessarily kept close in touch.

"While the Directors recognize the right of Mr. Daveis to be relieved from the care of the details of the Company's business devolving upon the President as a duty they are pleased to know that the Company is to have the benefit of his experience and advice as a member of this Board, and they invite him to retain his desk and make himself as much at home in the room known as the President's as he was while he was President of the Company."

Under the terms of its agreement with the city the United Gas Improvement Company recently paid to the City Controller of Philadelphia tho sum of $174,921.45, which sum represented 10 per cent. on its receipts for gas sales during the quarter ended December 31, 1905. The total payment on such license account for the year 1905 was $679,932.84.

At a meeting of the Board of Directors of the Boston Chamber of Commerce, held the last week in January, one of the subjects considered was as to the advisability of recommending the municipality of Boston to engage in the operation of gas and electric lighting plants on public account. The result of the debate is shown in the following resolutions, which were adopted without dissent:

Whereas, By opinion rendered to the Mayor of the city of Boston by the Corporation Counsel, it appears that the passage by the City Council of a vote establishing a municipal gas and electric lighting plant, if ratified by a majority of the voters of Boston, would irrevocably bind the city to purchase the existing private gas and electric lighting plants now established in said city; and,

Whereas, Such purchase might plunge the city into indebtedness far above the amount which could legally be met by an issue of bonds without the debt limit; and

Whereas, It appears that no investigation has been made in behalf of the city as to the probable cost of said purchase, or as to the possible gain to the people of the city by said action; and

Whereas, Any excess of indebtedness incurred by said purchase over and above the amount which could lawfully be paid by the issue of said bonds would have to be raised by direct levy upon the property of the inhabitants of the city; now, therefore,

The Board of Directors of the Boston Chamber of Commerce, without in any way committing itself, either for or against the principles of municipal ownership and operation of gas and electric lighting plants, herewith places upon record its conviction that, under existing conditions such proposed action of the City Council would be most inexpedient and fraught with danger to the best interest of the citizens and taxpayers of this city.

Mr. J. S. Dixon, formerly prominent in the service of the Utica (N. Y.) Gas Company, has associated himself with Mr. J. C. Dewhurst, under the firm name of Dewhurst & Dixon, to engage in the general contracting business. Their headquarters are No. 5 Arcade Building, Utica, N. Y.

Mr. J. Wesley Grace, formerly Superintendent of Mains and Services of the Hudson district of the Public Service Corporation of New Jersey, was tendered a farewell dinner the last Saturday in January by his associates. The service was made in "The Astor," this city, and chief engineer E. J. Donohue was toastmaster; and a good one he made. Mr. Grace left the Public Service to take up the duties of an important position with the Bethlehem (Pa.) Steel Works.

The Market for Gas Securities.

There is no change to report in the values of Consolidated Gas as between times of writing, the figures being virtually the same. It is figured by those who are wise that the "wholesale" rate for New York city under the old scale will not exceed 80 cents. In our belief the rate will not be more than 90 cents, with a graded reduction to 75 cents within a period that will enable some to cultivate a crop of different colored hair. The fact is that the gas sold in New York is pretty cheap at $1 per 1,000.

Peoples, of Chicago, is off a bit, but the pirates have not, and it does not seem they will be able to, change the rate to less than a reasonable one. The general situation in the gas line is in favor of the investor.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 Wall Street, New York City.

February 5.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid*	*Asked.*
Consolidated	$73,177,000	100	180	180½
Central Union, Bonds, 5's	3,000,000	1,000	108	110
Equitable Bonds, 6's	1,000,000	1,000	..	105
" 1st Con. 5's	2,300,000	1 000	118	120
Mutual	3,500,000	1 00	275	290
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	107	109
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union, Bonds, 5's	1,250,000	1,000	105	107
New York and East River.. Bonds 1st 5's	3,500,000	1,000	112	114
" 1st Con. 5's	1,500,000	..	106½	108½
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
Bonds, 1st Mortgage, 5's	1,500,000	1,000	111	114
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	170	180
" " Bonds (5's)	15 000,000	1,000	112	113
Bay State	50,000,000	50	⅝	..
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000.000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	10	12
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	55
Bonds (6 s)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co	29,500,000	100	106⅛	106¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	..	95
Preferred	3,026,500	100	107½	108
Consumers, Toronto	,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	84¼	85
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	915,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	..	98
Detroit Gas Co., 5's	351,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
For Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	110	110½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	86
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	.	..
Preferred	2,500,000	100	100	105
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind	1,000,000	100	..	60
Bonds	1 000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	100	100⅛
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	.
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105½
San Francisco, Cal	15,800,000	100	58½	58¾
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465.000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	303¾	305
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600.000	50	230	..

Advertisers' Index.

GAS ENGINEERS.

A. E. Boardman, New York City ... 237
Baxter & Young, Detroit, Mich ... 255
B. E. Chollar, St. Louis, Mo ... 248
Cruse-Kemper Co, Philadelphia, Pa ... 244
David Leavitt Hough, New York City ... 255
Davis & Farnum Mfg. Co., Waltham, Mass ... 256
Economical Gas Apparatus Construc'n Co., Toronto, Ont ... 237
Frank D. Moses, Trenton, N. J ... 244
Fred. Bredel Co., Milwaukee, Wis ... 254
Frederic Egner, Washington, D. C ... 260
H. M. Byllesby & Co., Chicago, Ills ... 248
Humphreys & Glasgow, New York City ... 257
Isbell-Porter Co., Newark, N J ... 258
J. F. W. Jost, Philadelphia, Pa ... 243
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 256
The Gas Machinery Co., Cleveland, O ... 240
The Jeffrey Manufacturing Co., Columbus, O ... 254
United Gas Improvement Co., Philadelphia, Pa ... 251
Western Gas Construction Co., Fort Wayne, Ind ... 264

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City ... 237
Bartlett, Hayward & Co., Baltimore, Md ... 257
Baxter & Young, Detroit, Mich ... 255
Connelly Iron Sponge & Governor Co., New York City ... 253
Continental Iron Works, Brooklyn, N. Y ... 258
Cruse-Kemper Co., Philadelphia, Pa ... 244
Davis and Farnum Mfg. Co., Waltham, Mass ... 256
Deily & Fowler, Philadelphia, Pa ... 260
Economical Gas Apparatus Construc'n Co., Toronto, Ont ... 237
Empire Gas Construction & Improvement Co., N. Y. City ... 245
Frank D. Moses, Trenton, N. J ... 244
Fred. Bredel Co., Milwaukee, Wis ... 254
G. Shepard Page's Sons, New York City ... 253
Humphreys & Glasgow, New York City ... 257
Isbell-Porter Company, New York City ... 258
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 256
Lloyd Construction Co., Detroit, Mich ... 240
Logan Iron Works, Brooklyn, N. Y ... 260
Quintard Iron Works, New York City ... 257
R. D. Wood & Co., Philadelphia, Pa ... 258
Riter-Conley Mfg. Co., Pittsburgh, Pa ... 259
Stacey Mfg. Co., Cincinnati, O ... 259
The Gas Machinery Co., Cleveland, O ... 240
The Jeffrey Manufacturing Co., Columbus, O ... 254
United Gas Improvement Co., Philadelphia, Pa ... 251
Western Gas Construction Co., Fort Wayne, Ind ... 264

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md ... 255
B. E. Chollar, St. Louis, Mo ... 248
Economical Gas Apparatus Construc'n Co, Toronto, Ont ... 237
Fred. Bredel Co., Milwaukee, Wis ... 254
Humphreys & Glasgow, New York City ... 259
The Gas Machinery Co., Cleveland, O ... 240
United Gas Improvement Co., Philadelphia, Pa ... 251
Western Gas Construction Co., Fort Wayne, Ind ... 264

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N.Y ... 258
Cruse-Kemper Co., Philadelphia, Pa ... 244
Davis & Farnum Mfg. Co., Waltham, Mass ... 256
Economical Gas Apparatus Construc'n Co., Toronto, Ont ... 237
Fred. Bredel Co., Milwaukee, Wis ... 254
Isbell-Porter Co., Newark, N. J ... 258
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 256
Logan Iron Works, Brooklyn, N. Y ... 260
R. D. Wood & Co., Philadelphia, Pa ... 258
Riter-Conley Mfg. Co., Pittsburgh, Pa ... 259
Stacey Mfg. Co., Cincinnati, O ... 259
The Gas Machinery Co., Cleveland, O ... 240
Western Gas Construction Co., Fort Wayne, Ind ... 264

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construc'n Co., Toronto, Ont ... 237
R. D. Wood & Co., Philadelphia, Pa ... 258

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construc'n Co., Toronto, Ont ... 237
Fred. Bredel Co., Milwaukee, Wis ... 254
Isbell-Porter Co., Newark, N. J ... 258
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 256
Stacey Mfg. Co., Cincinnati, O ... 259
The Gas Machinery Co., Cleveland, O ... 240
Western Gas Construction Co., Fort Wayne, Ind ... 264

AMMONIA CONCENTRATORS.

Fred. Bredel Co., Milwaukee, Wis ... 254
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 256
Michigan Ammonia Works, Detroit, Mich ... 236
The Gas Machinery Co., Cleveland, O ... 240
Western Gas Construction Co., Fort Wayne, Ind ... 264

GAS METERS.

American Meter Co., New York and Philadelphia ... 263
Detroit Meter Company, Detroit, Mich ... 263
D. McDonald & Co., Albany, N. Y ... 261
Helme & McIlhenny, Philadelphia, Pa ... 263
John J. Griffin & Co., Philadelphia, Pa ... 220
Keystone Meter Co., Royersford, Pa ... 262
Maryland Meter and Mfg. Co., Baltimore, Md ... 262
Metric Metal Co., Erie, Pa ... 263
Nathaniel Tufts Meter Co., Boston, Mass ... 262
New York Improved Meter Co., New York City ... 262
Pittsburgh Meter Co., Pittsburgh, Pa ... 261

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia ... 263
D. McDonald & Co., Albany, N. Y ... 261
Helme & McIlhenny, Philadelphia, Pa ... 163
John J. Griffin & Co., Philadelphia, Pa ... 220
Keystone Meter Co., Royersford, Pa ... 262
Nathaniel Tufts Meter Co., Boston, Mass ... 162
New York Improved Meter Co., New York City ... 262
Pittsburgh Meter Co., Pittsburgh, Pa ... 261

PREPAYMENT METER ATTACHMENTS.

New York Improved Meter Co., New York City ... 262
Reeves Mfg. Co., New Haven, Conn ... 239

WATER METERS.

Pittsburgh Meter Co., Pittsburgh, Pa ... 261

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass ... 256
Donaldson Iron Co., Emaus, Pa ... 248
Economical Gas Apparatus Construc'n Co., Toronto, Ont ... 237
R. D. Wood & Co., Philadelphia, Pa ... 258
Warren Foundry and Machine Co., New York City ... 248

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila ... 254
Perkins Co., New York City ... 254
Westmoreland Gas Coal Co., Philadelphia, Pa ... 255

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa ... 242

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., New York City ... 248

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y ... 242

GAS TAPPING MACHINES.

George Light, Dayton, O. 248
H. Mueller Manufacturing Co., Decatur, Ills. 246 248

CANNEL COALS.

Perkins & Co., New York City 254

STOKING MACHINERY.

G. A. Bronder, New York City 253

CONVEYORS.

Adam Weber Sons, New York City 252
Cruse-Kemper Co., Philadelphia, Pa. 244
C. W. Hunt Company, New York City 248
Dodge Coal Storage Co., New York City 248
Economical Gas Apparatus Construc'n Co., Toronto, Ont 247
Fred. Bredel Co., Milwaukee, Wis. 251
G. A. Bronder, New York City 253
Kerr Murray Mfg. Co., Fort Wayne, Ind. 256
The Gas Machinery Co., Cleveland, O. 240
The Jeffrey Manufacturing Co., Columbus, O. 251
The Link-Belt Engineering Co., Philadelphia, Pa. 24
The Link-Belt Machinery Co., Chicago, Ills 248
Western Gas Construction Co., Fort Wayne, Ind. 254

CHARGING BARROWS & COAL WAGONS.

Davis & Farnum Mfg. Co., Waltham, Mass. 156
Kerr Murray Mfg. Co., Fort Wayne, Ind. 256
Stacey Mfg. Co., Cincinnati, O. 250

GAS ENRICHERS.

Standard Oil Co., New York City, ... 255
Sun Company, Pittsburgh, Pa. 255
The Sun Oil Co., Pittsburgh, Pa. 255

COKE CRUSHERS.

C. M Keller, Columbus, Ind. 255
Fred. Bredel Co., Milwaukee, Wis. 254
The Jeffrey Manufacturing Co., Columbus, O. 154

ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N. Y. 245

GAS GAUGES.

The Bristol Co., Waterbury, Conn. 240

GAS GOVERNORS.

Connelly Iron Sponge & Governor Co., New York City. 253
Fred. Bredel Co., Milwaukee, Wis. 254
Isbell Porter Co., Newark, N. J. 258
Johnson-Reynolds Co., Anderson, Ind. 256
Pittsburgh Meter Co., Pittsburgh, Pa. 261
R. D. Wood & Co., Philadelphia, Pa. 258

CEMENTS.

C. L. Gerould, Pittsburgh, Pa 25

RETORTS AND FIREBRICKS.

Adam Weber Sons (Aberrt J. Weber's Construction) ... 252
Baltimore Retort and Firebrick Co., Baltimore, Md. ... 252
Brooklyn Firebrick Works, Brooklyn, N.Y. 252
Henry Maurer & Son, New York City 252
James Gardner, Jr., Co., Pittsburgh, Pa. 252
J. H. Gautier & Co., Jersey City, N. J. 252
Laclede Firebrick Mfg. Co., St. Louis, Mo. 252
Missouri Firebrick Co., St. Louis, Mo. 254
National Pyrogranit Co., New York City 252
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 253
St. Louis Gas Construction Co., St. Louis, Mo. 212

INCLINED RETORTS.

Adam Weber Sons (Graham-Morton [England] System) 252
Fred Bredel Co., Milwaukee, Wis. 254
Parker-Russell Mining and Mfg. Co., St. Louis, Mo 253
St. Louis Gas Construction Co., St. Louis, Mo. 252

VERTICAL S'S.

Adam Weber Sons, New York City. 252
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 253
Fred. Bredel Co., Milwaukee, Wis. 254
Parker-Russell Mining and Mfg. Co., St. Louis, Mo 253
St. Louis Gas Construction Co., St. Louis, Mo. 252

VERTICAL RETORTS, CHARGING AND DISCHARGING VERTICALLY.

Adam Weber Sons, New York City 252

REGENERATIVE FURNACES.

Adam Weber Sons, New York City 252
Bartlett, Hayward & Co., Baltimore, Md. 257
Fred. Bredel Co., Milwaukee, Wis. 254
J. H Gautier & Co., Jersey City, N. J. 252
Laclede Firebrick Mfg. Co., St. Louis, Mo. 240
Missouri Firebrick Co., St. Louis, Mo. 252
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 253
St. Louis Gas Construction Co., St. Louis, Mo. 252

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N. Y. 258
Davis & Farnum Mfg. Co., Waltham, Mass. 256
Fred. Bredel Co., Milwaukee, Wis. 254
Isbell-Porter Co., Newark, N. J. 258
Kerr Murray Mfg. Co., Fort Wayne, Ind. 256
Logan Iron Works, Brooklyn, N. Y. 260
R. D. Wood & Co., Philadelphia, Pa. 258
Stacey Mfg. Co., Cincinnati, O 250
The Gas Machinery Co., Cleveland, O. 240
Western Gas Construction Co., Fort Wayne, Ind. 264

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City 258

INCANDESCENT GAS LAMPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn. 198
General Gas Light Co., Kalamazoo, Mich. 239
Geo. G. Ramsdell, New York City 150
Welsbach Company, Gloucester, N. J. 250

BURNERS.

D. M. Steward Mfg. Co., Chattanooga, Tenn. 198
Wm. M. Crane Co., New York City. 215

(Continued on page 237.)

GAS WORKS, HATTIESBURG, MISS.

Sealed proposals will be received until 12 o'clock, noon, February 8th, 1906, for 50,000 cubic foot, single lift holder, two benches of 6's, exhauster, extractor, condenser, scrubber, purifiers, meter, boiler, heater, compressors and building as specified. Work to be done under rules of the American Public Works Association. Plans and specifications on file at First National Bank, Hattiesburg, Miss., and at office of Edward J. O'Beirne, Engineer, Empire Bldg., Atlanta, Ga. Right is reserved to reject any or all bids.

1598-3 HATTIESBURG GAS CO., H. A. CAMP, Pres.

WANTED,

A Situation as Superintendent of Gas Works,

By a thoroughly practical man. Experienced in coal and water gas. A good business pusher. Can show the best results. Address, "M. A. R.,"

1599-2 Care this Journal.

Situation Wanted

By a Young Man in a Gas Office.

Understands all the latest time-saving systems, the handling of merchandise, cashier's work, etc.

Address, "J. F. M.,"

16 0-1 Care this Journal.

Position Wanted

By a young man, experienced in the gas, electric and water business as bookkeeper, collector and solicitor, and familiar with the manufacture and distribution of both coal and water gas.

Address, "POSITION,"

1599-2 Care this Journal.

WANTED,

AN ALL ROUND GASFITTER,

For laying mains, services, meter and fitting work. One who is competent and trustworthy and understands the adjustment and setting of all gas appliances. A steady position for the right man. State salary and send references to

J. A. PAITEN, SUPT.,
1600-1 Manitowoc Gas-Light Co., Manitowoc, Wis.

WANTED,

A First-Class Meter Repairer.

Married man, who can keep from drinking liquor to excess, will be given steady work, wages $3.50 per day. Address, with references, WM. B. MILLER, Supt. Gas Dept. Birmingham Railway, Light & Power Co., Birmingham, Ala.
1599-2

WANTED,

METER REPAIRER.

Steady work for the right man. Give references and wages expected. Address

THE BRIDGEPORT GAS LIGHT CO.,
1599-1m BRIDGEPORT, CONN.

WANTED.

Gasfitters Experienced in all branches of the Business

Wanted by a gas company located in the central part of Pennsylvania. Address, stating age, experience, and salary expected, "W. G. C.,"

1600-1 Care this Journal.

WANTED,

GOOD MAN to act as gas foreman. One to take the initiative and be a working foreman in laying mains, services and general distribution work. None but good men need apply.

Address, "K. W. C.,"

1600-3 Care this Journal.

WANTED,

A young man who thoroughly understands gas arc lamps and the gas arc lighting business, to take charge of the gas arc business of a company now operating about 1,000 gas arcs. Must be able and willing to assemble, hang and repair lamps, and understand system of lamp records. Opportunity for a hustling, energetic man to show excellent results.

1600-1 Address, "GAS ARC," care this Journal.

GAS COMPANY supplying suburban district of New York city desires to engage a man capable of taking candle power on the bar and making chemical analyses of gas. Address, stating age, experience, and salary expected,

NEW YORK AND QUEENS GAS CO.,
1598-3 208 Fifth Avenue, New York City.

FOR SALE,

Second-Hand Meters.

1,467 three light, standard makes.
49 two light, standard makes.
31 three-light prepay.

In good condition. Prices on application. Address,
LOGAN NATURAL GAS & FUEL CO., Columbus, O.
1599-5

APPARATUS FOR SALE.

Station Meter, 5 feet by 5 feet, capacity 9,000 feet per hour. Complete, with gauges, stand, 8-inch elbows, etc.
One Upright Scrubber, 3 feet by 12 feet; 8-inch connections.
One Upright Tubular Condenser, 3 feet by 12 feet; 8-inch connections.
One Upright Tubular Condenser, 2 feet 6 inches by 11 feet; 8-inch connections. All above in good order.

Address, W. L. SECORD, Supt.,
1599-1m Northern Westchester Lighting Co., Ossining, N. Y.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

IMPROVED AMMONIA CONCENTRATOR.

About 100 in use. Write to

STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS, Detroit, Mich.

GREENPOINT

O·X·I·D·E

IS RELIABLE.

We quote "delivered" prices.
May we not send you a sample?

Greenpoint Chemical Works, Brooklyn, N. Y.

Practical Handbook on

GAS ENGINES,

With Instructions for Care and Working of the Same,

By G. LIECKFELD, C.E.

Translated with Permission of the Author,
By GEO. M. RICHMOND, M.E.

Price, $1. For Sale by
A. M. CALLENDER & CO.,
No. 42 Pine Street, New York City.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by
A. M. CALLENDER & CO., 42 PINE ST., N.Y. CITY

(*Concluded from page 236.*)

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 198

STREET LAMPS.

Thos. T. W. Miner, New York City..... 248
Welsbach Street Lighting Co., New York and Phila... 250

PURIFIERS.

Connelly Iron Sponge & Governor Co., New York City.. 253
Cruse-Kemper Co., Philadelphia, Pa..... 244
Davis & Farnum Mfg. Co., Waltham, Mass..... 256
Fred. Bredel Co., Milwaukee, Wis..... 254
Isbell-Porter Co., Newark, N. J..... 258
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 256
R. D. Wood & Co., Philadelphia, Pa..... 260
Stacey Mfg. Co., Cincinnati, O..... 259
Western Gas Construction Co., Fort Wayne, Ind. 264

PURIFYING MATERIALS.

Connelly Iron Sponge & Governor Co.. New York City. 253
Greenpoint Chemical Works, Brooklyn, N. Y..... 246

VALVES.

Continental Iron Works, Brooklyn, N. Y.. 260
Davis & Farnum Mfg. Co., Waltham, Mass..... 256
Economical Gas Apparatus Construc'n Co, Toronto, Ont 237
Isbell-Porter Co., Newark, N. J..... 260
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 256
Ludlow Valve Manufacturing Co., Troy, N. Y..... 245
R. D. Wood & Co., Philadelphia, Pa..... 260
Stacey Mfg. Co., Cincinnati, O..... 259
The P. H. & F. M. Roots Co., Connersville, Ind..... 247
Western Gas Construction Co., Fort Wayne Ind 264

EXHAUSTERS.

Connelly Iron Sponge & Governor Co., New York City.. 253
Connersville Blower Co., Connersville, Ind..... 241
Davis & Farnum Mfg. Co., Waltham, Mass..... 256
Isbell-Porter Company, Newark, N. J..... 260
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 256
The P. H. & F. M. Roots Co., Connersville, Ind..... 247

PURIFIER SCREENS.

John Cabot, Hoboken, N. J..... 240
Western Gas Construction Co., Fort Wayne, Ind..... 264

GAS STOVES.

Albany Foundry Co., Albany, N. Y..... 237
American Meter Co., New York and Philadelphia..... 263
Detroit Stove Works, Detroit and Chicago..... 239
Keystone Meter Co., Royersford, Pa..... 262
Maryland Meter & Manufacturing Co., Baltimore, Md.. 262
Nathaniel Tufts Meter Co., Boston, Mass..... 262

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich..... 243

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y..... 248

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 257
Continental Iron Works, Brooklyn, N. Y..... 258
Cruse-Kemper Co., Philadelphia, Pa..... 242
Davis & Farnum Mfg Co., Waltham, Mass,..... 256
Deily & Fowler, Philadelphia, Pa..... 260
Economical Gas Apparatus Construc'n Co., Toronto, Ont 237
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 256
Logan Iron Works, Brooklyn, N. Y..... 160
R. D. Wood & Co., Philadelphia, Pa 258
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 250
Stacey Mfg. Co., Cincinnati, O..... 259
Western Gas Construction Co., Fort Wayne, Ind..... 264

STORAGE TANKS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 256
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 251
Stacey Mfg. Co., Cincinnati, O..... 259
Western Gas Construction Co., Fort Wayne, Ind 264

PAINTS.

American Standard Composition Co., New York City.. 243

PATENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C..... 240

HYDRAULIC MOTORS.

Hydraulic Motor Service Co., New York City..... 243

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS, SPECIFICATIONS AND ESTIMATES PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

ARTHUR E. BOARDMAN, C.E.,

For several years associated with the late CAPTAIN WILLIAM HENRY WHITE,

WILL CONTINUE THE BUSINESS OF

CONSULTING ENGINEER

For Gas, Water and Electric Light Companies, at
No. 41 Wall Street, Room 1707, New York.
TELEPHONE, 5534 BROAD.

THIRTY-FIFTH SERIES

ARGAND

GAS RANGE.

FEATURES:

Convenient for Operating.
Plate Warmer, full size of Range.
Improved Open Door Lighter.
Centrifugal Burner.
Locking Oven Cocks Attachment.
Circular Corners.

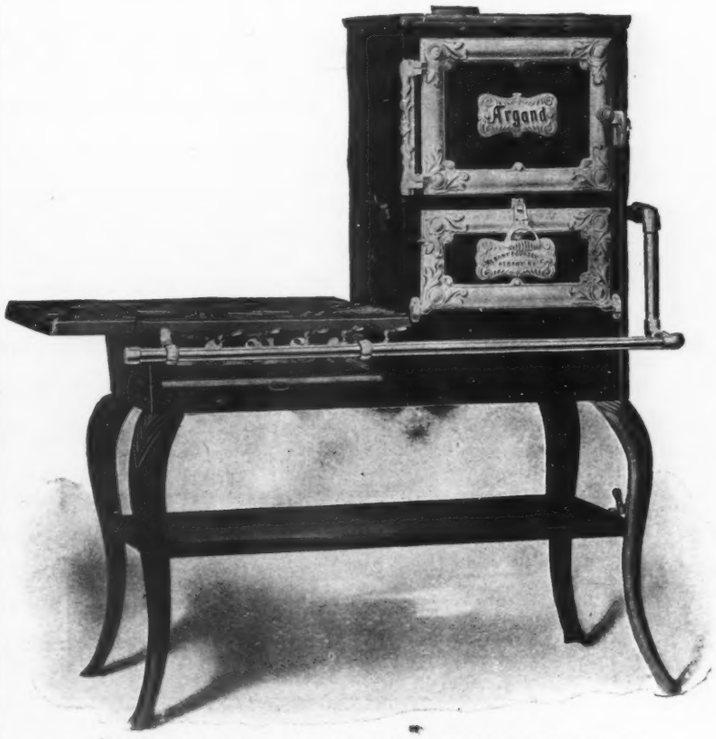
SEND FOR CATALOGUE.

ALBANY FOUNDRY CO.,

Manufacturers of the Argand Line of Gas Appliances,

Albany, N. Y.

Philadelphia Branch—CHAS. C. HEATH & CO., Managers, 136-138 North 2d Street.



No. 35-16 and No. 35-18, with Oven, Broiler and Low Plate Warmer. Width, less Shelf, only 7 inches more than the ordinary Range.

DIMENSIONS.

Height Oven Top,	55 Inches.
Width,	51 "
Width, less shelf,	44 "
Height Operating Top,	31 "
Plate Warmer,	17 x 44 "

H. M. Byllesby & Company

(Incorporated).

GAS ENGINEERS,

DESIGN, CONSTRUCT AND OPERATE COMPLETE COAL, WATER AND CRUDE OIL GAS PLANTS.

HIGH AND LOW PRESSURE DISTRIBUTING SYSTEMS.

171 LA SALLE STREET,

CHICAGO.

SCIENTIFIC BOOKS.

COAL TAR AND AMMONIA. By George Lunge. $15.

ELECTRIC GAS LIGHTING. By H. S. Norrie. 50 cents.

GAS ANALYST'S MANUAL. By J. Abady. $6.50.

COX'S GAS FLOW COMPUTER. $2.50.

THE "GAS WORLD" YEAR BOOK, 1906. Edited by John Douglas. $3.

GAS AND GAS WORKS. By Hughes and O'Connor. $2.40

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor $3.50.

TECHNICAL GAS ANALYSIS. By Winkler & Lunge. $4.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

PRACTICAL TREATISE ON HEAT. By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

HEMPEL'S GAS ANALYSIS, $2.25.

SELF-INSTRUCTION FOR STUDENTS IN GAS MANUFACTURE. Elementary and advanced, each, $1.50.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

FIELD'S ANALYSIS, 1904. $5.

HANDBOOK FOR GAS ENGINEERS AND MANAGERS. Seventh edition. By Thomas Newbigging. $6.50.

GAS, GASOLINE AND OIL ENGINES. By Gardner D. Hiscox. Fifteenth edition. $2.50.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfeld. $1.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

FINANCES OF GAS, ELECTRIC LIGHT AND POWER ENTERPRISES. By Wm. D. Marks. $2.50.

PRACTICAL PLUMBING. By P. J. Davies. Vol. I. $3, Vol II. $4.50.

AMERICAN SANITARY PLUMBING. By James J. Lawler. $2.

TREATISE ON MASONRY CONSTRUCTION. B ker. $5.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application of Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKET-BOOK. By Monroe and Jamieson. $2.50.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK.

HUMPHREY

Nickel Cylinder Lamps,

Used either with or without shades. Supplied with round or pear globes. :: ::

Just the lamp to offer the hesitating consumer who wants a different design.

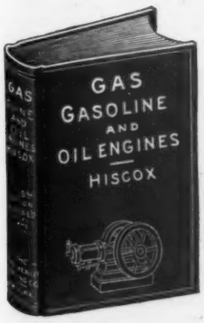
SHIPMENTS MADE FROM

Kalamazoo, Mich.
530 Market St., San Francisco.
46 West Broadway, New York.

General Gas Light Co.

Gas, Gasoline and Oil Engines,

INCLUDING GAS PRODUCER PLANTS.



By GARDNER D. HISCOX, M.E.,

Author of "MECHANICAL MOVEMENTS," "COMPRESSED AIR," Etc.

Fifteenth Edition. Revised, Enlarged and Reset.

PRICE, $2.50. For Sale by

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

THE SEVENTH EDITION, ILLUSTRATED,

— OF THE —

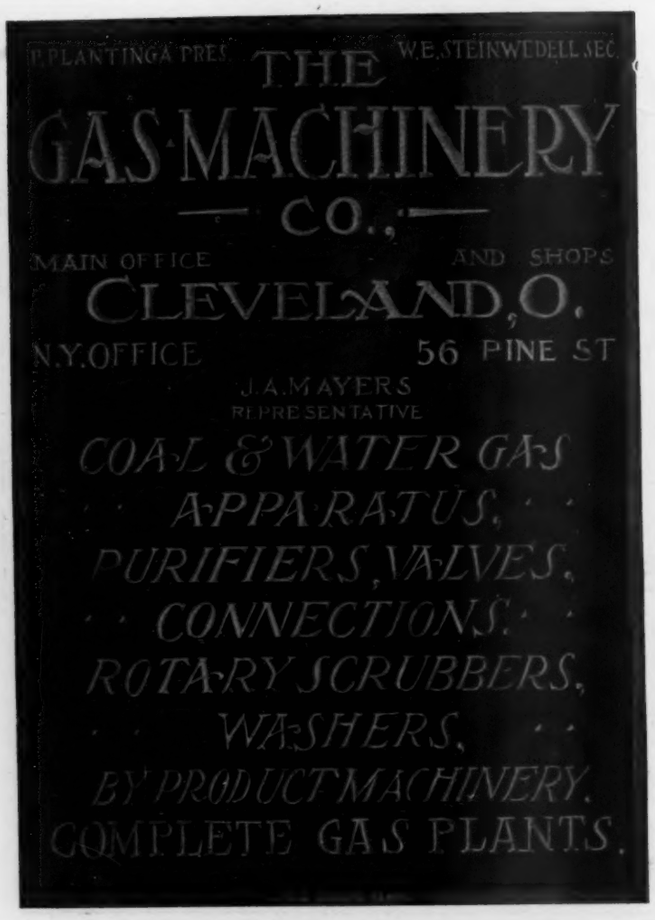
Handbook for Gas Engineers and Managers,

By THOMAS NEWBIGGING, M. INST. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions. Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

PRICE, · $6.50.

A. M. CALLENDER & CO., 42 Pine Street, New York City.



PRACTICAL PHOTOMETRY,

By WILLIAM JOSEPH DIBDIN,

PRICE, $3. FOR SALE BY

A. M. CALLENDER & CO., 42 Pine Street, New York City.

PATENTS, TRADE MARKS, COPYRIGHTS.

ROYAL E. BURNHAM,

Solicitor of Patents and Counsellor in Patent Causes.

833 Bond Building, Washington, D. C

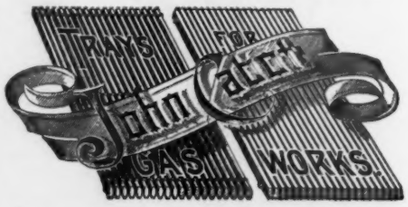
Send for Pamphlet on Patents.

1448-tf

Church's Patent Trays.

Reversible; Strongest; Most Easily Repaired.

Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.

We also Supply the Cheapest and Strongest

•Reversible Bolted Trays•

IN THE MARKET.

SEND FOR BOOKLET AND CIRCULARS.

Bristol's Recording

PRESSURE GAUGE.

For continuous records of **Street Gas Pressure.**

Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,

Waterbury, Conn.

Gold Medal, St. Louis Exposition.

THE BEST are THE CHEAPEST.

HOMOGENEOUS CONSTRUCTION ~ PERFECT FINISH ~ LONGEST CONTINUOUS LIFE.

WE HAVE RETORTS MAKING GAS TO-DAY THAT HAVE BEEN IN CONSTANT USE FOR 52 MONTHS.

Awarded the Only **GRAND PRIZES** At St. Louis Exposition

BY A JURY COMPOSED OF THE MOST COMPETENT ENGINEERS OF FOUR CONTINENTS, FOR SUPERIOR

RETORTS * GAS BENCHES * FIREBRICK.

Designs and Estimates Cheerfully Furnished.

LACLEDE FIREBRICK MANUFACTURING COMPANY,

ST. LOUIS, MO.

WHY DO GAS EXHAUSTERS

AND HIGH PRESSURE GAS PUMPS BUILT BY

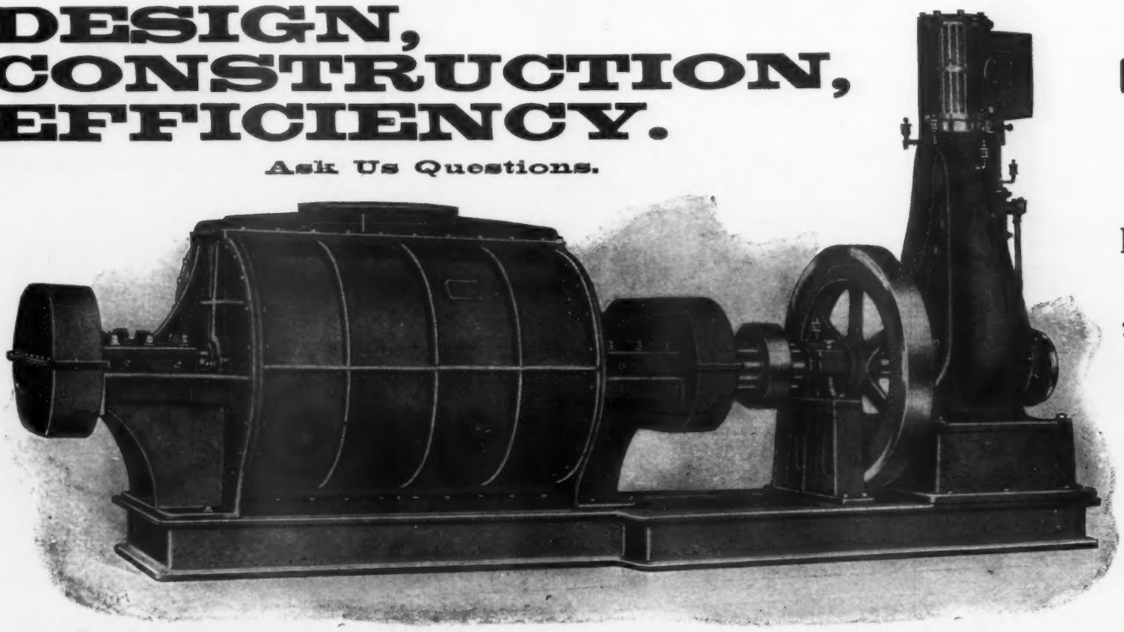
THE CONNERSVILLE BLOWER CO.

Stand so High in the estimation of those using them?

THE ANSWER IS IN THREE WORDS:

DESIGN, CONSTRUCTION, EFFICIENCY.

Ask Us Questions.



Home Office:
CONNERSVILLE, IND.

Eastern Sales Agent:
HORACE G. COOKE,
95 Liberty Street, New York City.

Write us about our Improved Stuffing Boxes.

Something Entirely New.

DETROIT STOVE WORKS

"Largest Stove Plant in the World"

MANUFACTURES AND SELLS

DETROIT JEWEL GAS APPLIANCES

FOR COOKING and HEATING,

All about which is told in a fine and strictly "to-the-point" catalog, sent upon request to Gas Companies.

DETROIT, MICH.
CHICAGO, ILLS.

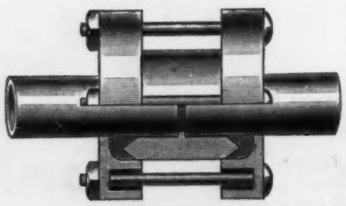
The "Gas World" Year Book, 1906,

Edited by JOHN DOUGLAS.

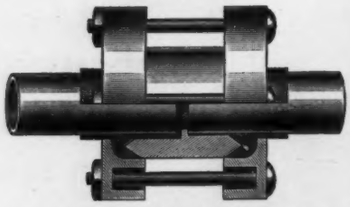
Technical Data, Diary and Handy Tables for Gas Engineers and Managers, Directory of English Gas Companies, Analyses of Accounts of Gas Undertakings, etc.

Price, $3. For Sale by

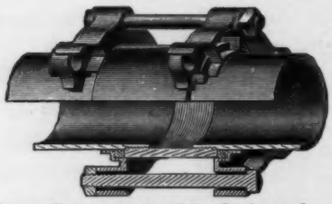
A. M. CALLENDER & CO., - 42 Pine Street, New York City.



Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.



Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe,



Clamp, Style 4, for Repairing Leaks on Screw Collar.

Long Sleeve, Style 2, for Mending Broken Lines.

S. R. DRESSER MANUFACTURING CO.,

SUCCESSORS TO

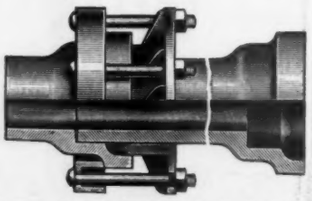
S. R. DRESSER,

BRADFORD, PA., U. S. A.,

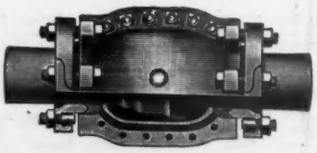
Patentee and Manufacturer of Specialties for Gas and Water Lines,

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

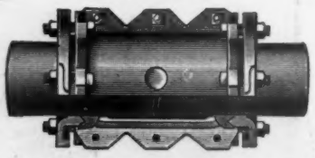
STATE REQUIREMENTS AND SEND FOR CATALOGUE.



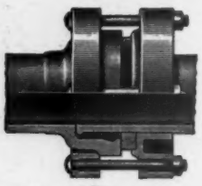
Coupling, Style 9, for Special Style Cast Iron Pipe.



Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.



Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.



Clamp, Style 4½, for Repairing Leaky Lead or Cement Joints in Cast Iron Pipe.

MAIN AND SERVICE LAYING.

Gas and water companies about to lay new mains or services will find it useful to communicate with us. Our gangs are experienced and our plant is completely equipped for street main and service laying in all branches. These are our specialties. We are in a position to quote prices which will attract the attention of the economical manager.

Gas Company References. Correspondence Solicited.

Telephone, 302 Flushing. SULLIVAN BROS., Flushing, N. Y.

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 cents. Orders may be sent to

A. M. CALLENDER & CO., 42 PINE ST., N. Y CITY.

FIELD'S ANALYSIS

For the Year 1904.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 36th Year of Publication.

COMPILED AND ARRANGED BY **JOHN W. FIELD,**

Secretary and General Manager of The Gas Light and Coke Company, London.

PRICE, 8s. FOR SALE BY

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

THE AMERICAN STANDARD COMPOSITION CO.

—MANUFACTURES—

HEAT PROOF AND DAMP PROOF PAINTS

For Structural Iron and Steel, Gas Apparatus, Underground Piping, Boiler Fronts, Stacks, etc.

Our Paints will not crack, peel or scale. Heat does not affect them. They are moisture proof.

They are the Paints that Don't Come Off!

We let you Try before you Buy. Send for samples and prices.

AMERICAN STANDARD COMPOSITION COMPANY,

1707, Wall Street Exchange Building, New York.

FOR HOT BATHS,

And for every other Hot Water Need, use the

IMPROVED

HUMPHREY CRESCENT INSTANTANEOUS WATER HEATERS.

Efficient. Compact. Durable. Every Heater Guaranteed.

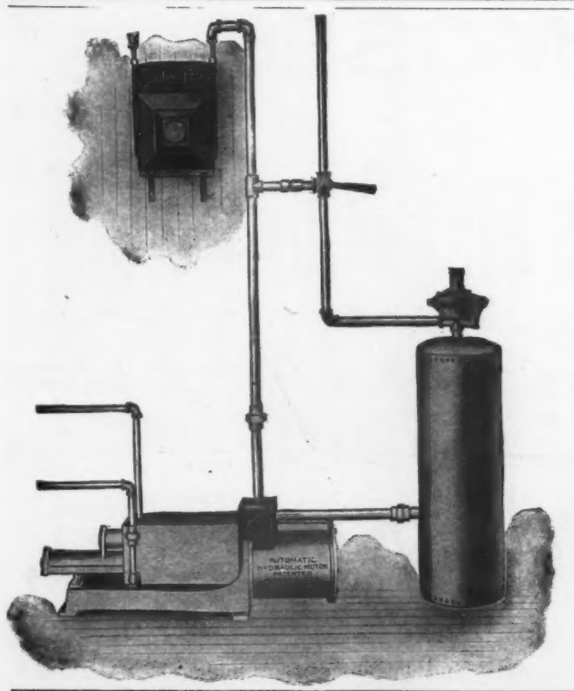
No. Heater.	Price.	Gas Supply from Meter.	Heats Gals. per Min. 50° in Temperature.	Height.	Diameter.	Shipping Weight.
Non-contact 2	$35.00	¾ Inch.	2½	34⅝ Inches.	12 Inches.	70 Pounds.
" 1	30.00	¾ "	2	31 "	10¾ "	62 "
Contact 6	25.00	¾ "	3	29½ "	12 "	60 "
" 8	20.00	½ "	2½	29⅝ "	10¼ "	48 "
" 9	17.00	⅜ "	1	24 "	9¼ "	45 "

These prices include Safety Valves and Unions, one Bent Output Spout. For prices of fittings see our complete catalogue, "The Luxury of a Bath."

We will be glad to quote discounts.

HUMPHREY CO., · · · Kalamazoo, Mich.

The ONLY manufacturers in the world of a complete line of Instantaneous Water Heaters.



THE AUTOMATIC HYDRAULIC MOTOR.

(A Gas Booster.)

Gas Companies can give consumers five times the candle power they get from low pressure by using "GAS BOOSTERS."

We supply them for rental to consumers. Send for booklet. : : : : :

Hydraulic Motor Service Company,

14 & 16 Park Place, New York.

The Gas Engineer's Pocket-Book,

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

For Sale by

A. M. CALLENDER & CO., 42 Pine Street, New York City.

J. F. W. JOST,

CHEMICAL ENGINEER

—IN—

GAS MANUFACTURE,

P. O. BOX 2043, PHILADELPHIA, PA.

The "HUNT" CONVEYOR.

Noiseless in Operation.

Write for Catalogue 053.

C. W. HUNT COMPANY,

West New Brighton, New York.

THE

Valuation of Gas, Electricity and Water Works

FOR ASSESSMENT PURPOSES.

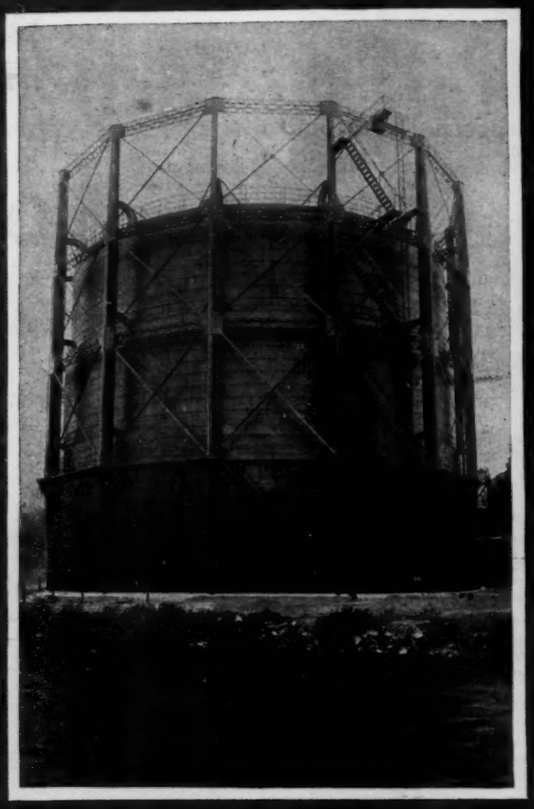
THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

With an Appendix of Decided Cases.

Second Edition. Price $2. For Sale by

A. M. CALLENDER & CO.,

42 Pine Street, N. Y. City.



ARTHUR R. CRUSE
President

A. E. KEMPER
Treasurer

HENRY W. SCATTERGOOD
Vice-President

FRANK FLAVELL
Secretary

CRUSE-KEMPER COMPANY

PHILADELPHIA OFFICES
1205-6 Stephen Girard Building

WORKS
Ambler, Pa

Manufacturers of

TRIPLE
DOUBLE and
SINGLE-LIFT
Gas Holders

WITH OR WITHOUT
METAL TANKS

Oil and Water Tanks
Purifier Covers
General Plate Metal Work and
Steel Water Towers

PLANS, SPECIFICATIONS AND ESTIMATES
PROMPTLY FURNISHED ON REQUEST

FRANK D. MOSES,

Telephone, 204-A TRENTON, N. J., Telephone, 204-A

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE.

CORRESPONDENCE SOLICITED.

Gas Analyst's Manual,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates.
Bound in Handsome Half Leather. Price, - $6.50.

FOR SALE BY

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

BRAY BURNERS

Have been Used for Forty Years by the Leading Gas Companies.

Cheaply gotten up and inferior imitations of the BRAY are constantly coming in and going out of use. We respectfully warn Gas Companies against the use of these infringing burners. What you may save in cost is more than lost in dissatisfaction to your consumer as well as to yourself. See that such burners as you use are STAMPED WITH BRAY'S NAME and MARKED "PATENTED." This is a guarantee against imitation and an insurance of a perfect burner.

Write us to-day for our Bray Blue Book. We will gladly send you same upon application.

W. M. CRANE COMPANY,

1131-1133 Broadway, New York, N. Y.,

We make Gas Appliances of all kinds. Sole Agents for the U. S.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

This 36"

TRUMP

Concrete Measuring and Mixing

MACHINE

makes 7 cubic yards of concrete per hour, with a crew of 4 men

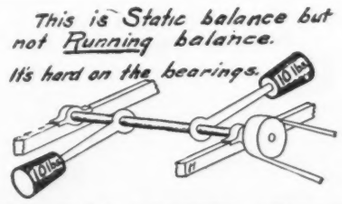
Write for Booklet 55, "Concrete."

The Link-Belt Engineering Co.,

PHILADELPHIA.

NEW YORK: 49 Dey St. PITTSBURGH: Park Building.

CHICAGO: The Link-Belt Machinery Co.



THE BALANCED WHEEL

Of a GREEN-MATTEAWAN FAN

produces neither noise nor vibration. It is as carefully balanced as the cutting cylinder of a wood planer, and in much the same manner; that is, it is adjusted not only for **static balance,** but also for **running balance.** To make this plain, suppose the shaft of a perfectly balanced blast wheel to rest on two horizontal straight edges and that a 10-pound weight be attached to one of the side plates. This weight would be balanced, as far as static balance is concerned, by attaching an equal weight to the other side plate and upon the opposite side of the shaft, but you would not then have a running balance. The two weights would try to get as far away from the center of rotation as possible, and the ends of the shaft would tend to travel in circles instead of lying quietly in a fixed axis of rotation. This is in accordance with that law of mechanics which states that rotating bodies always tend to turn about the axis which gives the greatest radius of gyration.

The only way in which a fan wheel can be satisfactorily balanced is by subjecting it to a running balancing test. This we have made provision to do, in line with our general policy of making the best possible kind of a Fan.

Write for our Fan Catalog "AG," and, if you do not have a copy, ask also for our Book on Boiler Plant Economy.

THE GREEN FUEL ECONOMIZER CO.,

Matteawan, New York.

(Sole Builders of Green Fuel Economizers in the United States.)

EMPIRE GAS IMPROVEMENT AND CONSTRUCTION CO.,

Contractors for the Installation of

COMPLETE GAS WORKS OR ANY PART THEREOF, INCLUDING

Houses, specially designed for room and economy.
Holders of any desired capacity, with or without Steel Tank.
Coal Gas Benches of every approved setting.

Standard Lowe Double Superheater Water Gas Sets.
Lowe-Sutherland Double Superheater Water Gas Sets.

Boilers, Engines, Blowers, Coal Elevators, Purifying Boxes, Tar Extractors, Scrubbers, Condensers, Exhausters, Station Meters, Street Mains and Governors.

Where necessary we give Bond in any required sum to guarantee speedy *completion* and *results.*

EMPIRE GAS IMPROVEMENT AND CONSTRUCTION CO., 49 Wall St., New York.

NEW DESIGNS FOR THE NEW SEASON.

Is it of interest to you to know that your dip pipes are all sealed absolutely the same?
That you can lock up your air slides and put the key in your pocket?
That your retorts carry none of the weight of your mouthpieces?
These advantages and many more are embodied in our

BENCH IRONWORK.

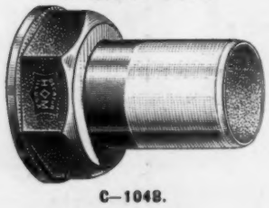
LLOYD CONSTRUCTION COMPANY,

DETROIT, MICH.

Western Agents
BARTLETT, HAYWARD & CO., Baltimore, Md.

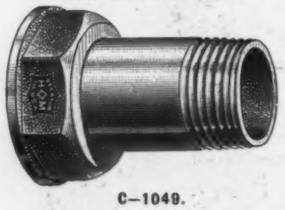
MUELLER GAS METER COUPLINGS.

FOR LEAD PIPE.



C—1048.

FOR IRON PIPE.



C—1049.

If gas meter couplings are not cored true the shell may be so thin on one side that the threads will not have enough metal to support them in the fitting process.

In making Mueller Gas Meter Couplings the cores are carefully set to center and moistened at the rests so they will hold up in place when the metal is poured. The threads have enough backing all around to make them secure in the fitter's hands.

Mueller Gas Meter Couplings are made in straight and bent patterns, in all sizes from 3 to 200-light and for all styles of pipe connection. One of the couplings illustrated is for lead pipe and the other for iron pipe.

Each coupling is carefully inspected, is given a 75-pound hydraulic pressure test, bears the Mueller trade mark, and is *unconditionally guaranteed.*

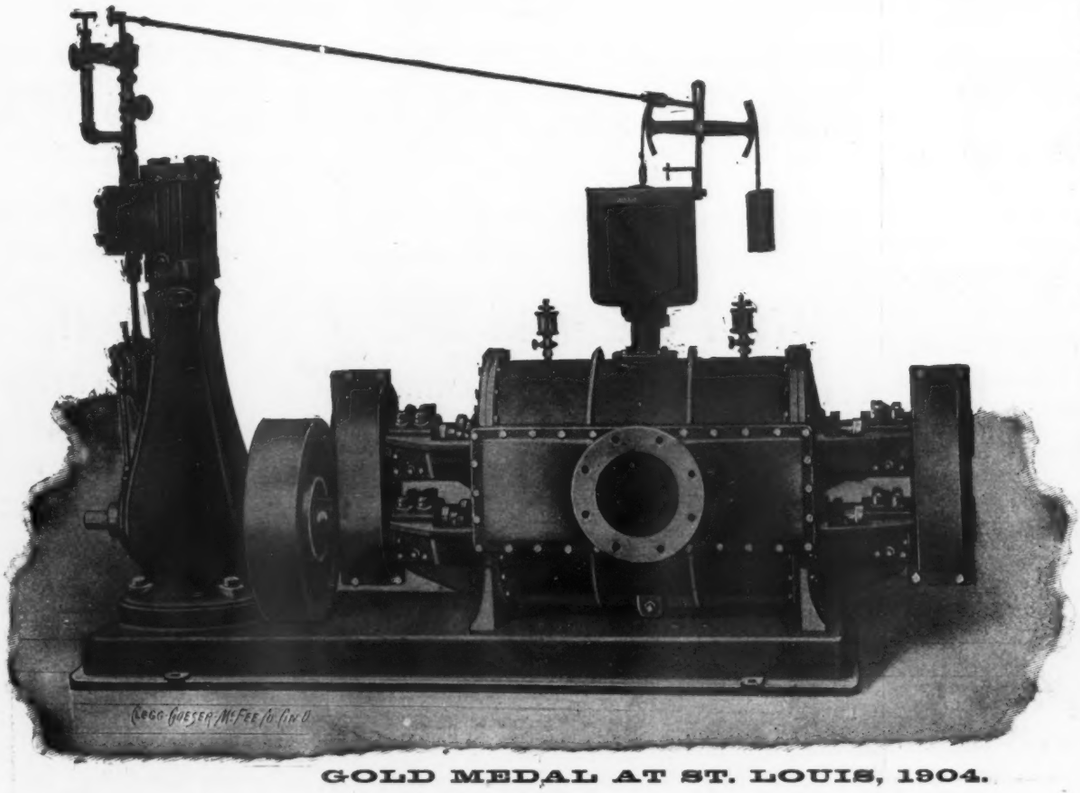
We also make tapping machines, gas cocks and meter connections for gas works' use. Catalogs upon application.

Works and General Offices
DECATUR, ILL., U. S. A.
West Cerro Gordo St.

H. MUELLER MFG. CO.

Eastern Division
NEW YORK, N. Y., U. S. A.
254-258 Canal St. (Cor. Elm)

ROOTS' GAS EXHAUSTERS.



GOLD MEDAL AT ST. LOUIS, 1904.

Sizes for any required capacity.

Self-oiling, adjustable bronze bearings.

Most perfect and sensitive Governor.

Write for Catalogue.

P. H. & F. M. ROOTS COMPANY,

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty St.

CHICAGO OFFICE:
1547 Marquette Bldg.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

WITH A VERY FULL COLLECTION OF TABLES OF HEATS OF COMBUSTION OF FUELS, SOLID, LIQUID AND GASEOUS.

TO WHICH IS ALSO APPENDED

THE REPORT OF THE COMMITTEE ON BOILER TESTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, DECEMBER (1897); TABLES OF CONSTANTS USED.

By HERMAN POOLE, F.C.S.

Second Edition. Price $3. For Sale by

A. M. CALLENDER & CO. - - No. 42 Pine Street, New York City.

PRACTICAL PHOTOMETRY,

A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.

By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations. Price, $3.00.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

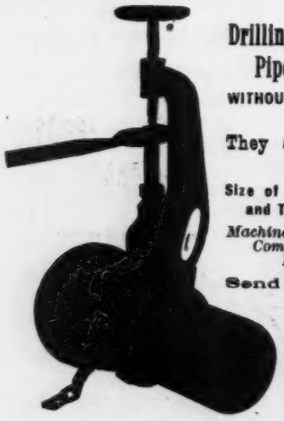
CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES

—FOR—



Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

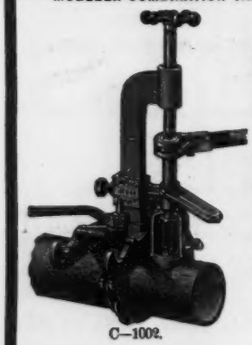
Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light,
DAYTON, O.

MUELLER COMBINATION TAPPING MACHINE.



C—1002.

The Mueller "Combination" Tapping Machine can be used with the gas cylinder for tapping under pressure, or without it for dry pipe tapping. This interchangeable feature makes it a very valuable tool for plants having both kinds of work to do with a small allowance for tools. Makes dry taps up to 3-inch and pressure taps up to 2-inch. Unconditionally guaranteed. Catalogues upon application.

H. MUELLER MFG. CO.,
Decatur, Ill., U. S. A. New York, N. Y., U. S. A.

"THE MINER"
Globe
Street and Boulevard
Lamps.
Cheapest and Best
THOUSANDS IN USE WITH INCANDESCENT BURNERS.
Send for Catalogues.
THOMAS T. W. MINER,
821-823 Eagle Av., N. Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

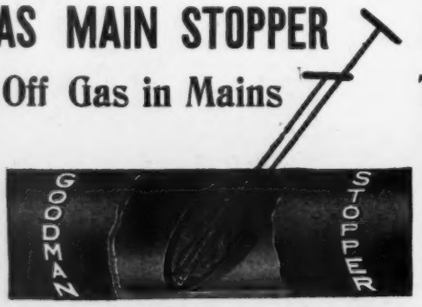
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :



Temporarily during alterations and repairs. : : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 1668 Park Ave., New York City.

TELPHER CARRYING COAL

from cars to storage at plant of the Rome Gas Light Co., Rome, N. Y. *Capacity of hoist,* 2,500 *pounds;* its speed, 60 feet a minute; conveying speed, 600 feet a minute. Timber construction spans railroad track and public street, preventing obstruction to travel.

Write for Booklet 53.

UNITED TELPHERAGE DEPARTMENT
The Dodge Coal Storage Co.

PHILADELPHIA—Hunting Park ave. & P. & R. Ry.
NEW YORK—49 Dey street.
BOSTON—164 Federal street.
CHICAGO—39th street and Stewart avenue.
PITTSBURGH—1501-2 Park Building.
PORTLAND, ORE.—309 McKay Building.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

BELT CONVEYORS

EQUIPPED WITH

BALL BEARING ROLLS

ARE THE BEST,

because they possess greater efficiency, consume less power, and the belts last longer than when any other type of roll is employed.

PLANS AND ESTIMATES FURNISHED ON REQUEST.

The Link-Belt Machinery Co.
Link-Belt Engineering Co. Philadelphia Chicago, U.S.A.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

FEBRUARY, 1906.

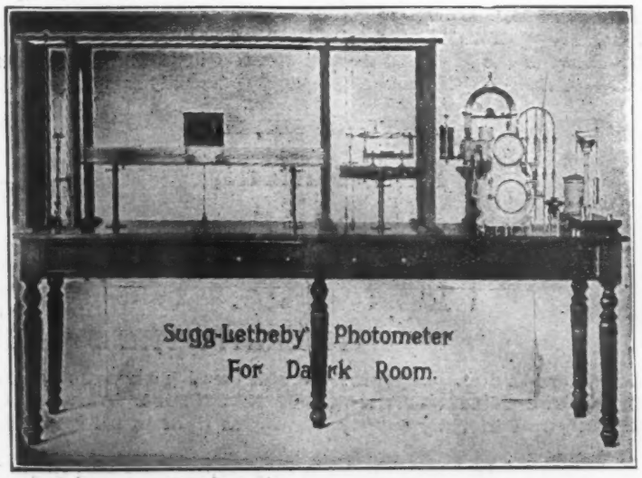
Table No. 1.
FOLLOWING THE MOON.

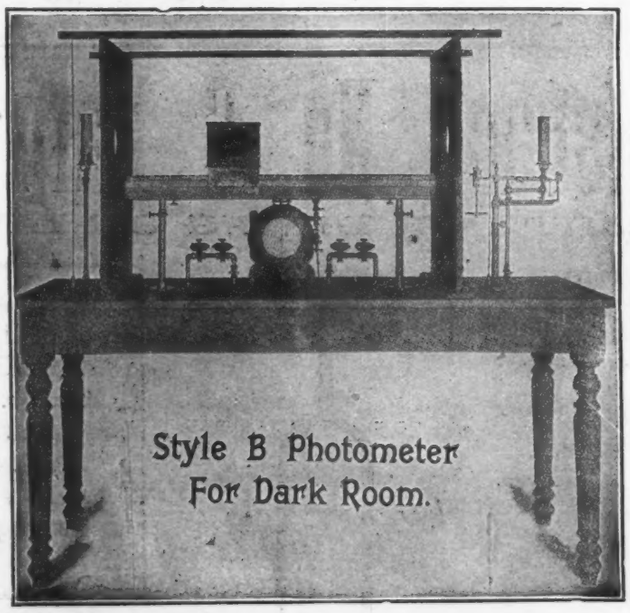
Day of Week.	Date.	Light.	Extinguish.
Thu.	1	12.20 AM FQ	6.10 AM
Fri.	2	1.10	6.10
Sat.	3	2.10	6.10
Sun.	4	3.00	6.10
Mon.	5	3.50	6.10
Tue.	6	4.40	6.10
Wed.	7	No L.	No L.
Thu.	8	No L. PM	No L.
Fri.	9	No L.	No L.
Sat.	10	6.00 PM	8.10 PM
Sun.	11	6.00	9.20
Mon.	12	6.00	10.30
Tue.	13	6.00	11.40
Wed.	14	6.00	12.50 AM
Thu.	15	6.00 LQ	1.50
Fri.	16	6.00	3.00
Sat.	17	6.00	4.00
Sun.	18	6.10	5.00
Mon.	19	6.10	5.50
Tue.	20	6.10	5.50
Wed.	21	6.10	5.50
Thu.	22	6.10 NM	5.50
Fri.	23	6.10	5.50
Sat.	24	6.10	5.50
Sun.	25	6.20	5.40
Mon.	26	6.20	5.40
Tue.	27	9.10	5.40
Wed.	28	10.10	5.40

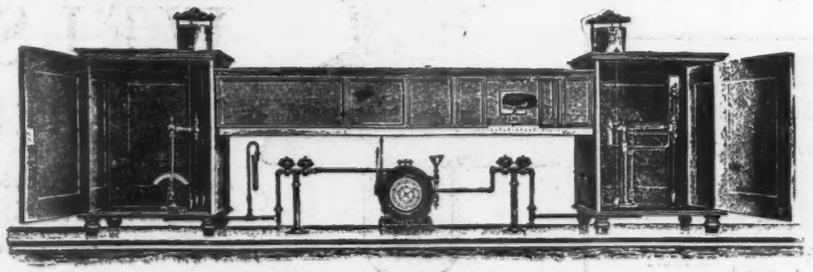
TOTAL HOURS DURING 1906.

By Table No. 1.

	Hrs.Min.
January	223.40
February	190.40
March	192.10
April	167.00
May	152.20
June	142.10
July	150.20
August	157.40
September	170.00
October	185.10
November	201.40
December	214.00
Total, yr.	2146.50







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

FEBRUARY, 1906.

Table No. 2.
NEW YORK CITY.
ALL NIGHT LIGHTING.

Day of Week.	Date.	Light.	Extinguish.
		A.M.	P.M.
Thu.	1	5.05	6.15
Fri.	2	5.05	6.15
Sat.	3	5.05	6.15
Sun.	4	5.05	6.15
Mon.	5	5.10	6.10
Tue.	6	5.10	6.10
Wed.	7	5.10	6.10
Thu.	8	5.10	6.10
Fri.	9	5.10	6.10
Sat.	10	5.10	6.10
Sun.	11	5.10	6.10
Mon.	12	5.20	5.55
Tue.	13	5.20	5.55
Wed.	14	5.20	5.55
Thu.	15	5.20	5.55
Fri.	16	5.20	5.55
Sat.	17	5.20	5.55
Sun.	18	5.20	5.55
Mon.	19	5.30	5.55
Tue.	20	5.30	5.55
Wed.	21	5.30	5.55
Thu.	22	5.30	5.55
Fri.	23	5.30	5.55
Sat.	24	5.30	5.55
Sun.	25	5.30	5.55
Mon.	26	5.30	5.45
Tue.	27	5.30	5.45
Wed.	28	5.30	5.45

TOTAL HOURS DURING 1906.

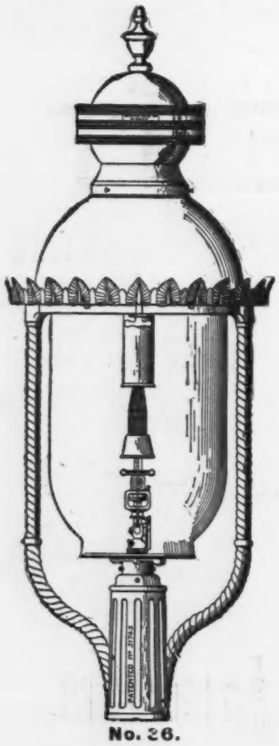
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street. BOSTON, 820 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, 218 La Salle Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 26.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

The Welsbach No. 6 Harp Fixture.

AN IDEAL LIGHT FOR DINING OR LIVING ROOMS.

THE HIGHEST MECHANICAL INGENUITY COMBINED WITH ORNAMENTAL BEAUTY--THE NEWEST OUTPUT FROM THE WELSBACH FACTORIES.

Equipped with new model No. 66 high candle power Welsbach Burner.

Side Pilot By-pass Tube covered with refractory sleeve to prevent bending.

Fourteen-inch Opal Dome Shade.

Polished Brass Embossed Crown 2¼ inches high.

Length of Fixture, 30 inches.

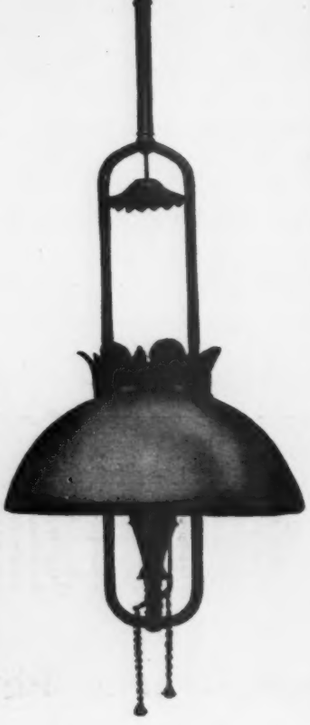
Width of Harp, 4½ inches.

Finished in Polished Brass.

Packed One Dozen to the Case.

List Price, per Dozen, $45.00.

We recommend equipping the No. 6 Harp Fixture with No. 4197 Intensive Brand Mantle, and the No. 306 **F. Q. M.** Clear Glass Air-Hole Cylinder.



Although the 14-inch Opal Dome Shade is standard equipment, we are prepared to furnish Dome Shades in green, pink or yellow (opal lined), and will be glad to quote prices.

WELSBACH CO.,

Salesrooms in all the principal cities of the United States.

Factories:

GLOUCESTER, N. J.
CHICAGO, ILL.

THE UNITED GAS IMPROVEMENT COMPANY

For the Year Ending December 31st, 1905, has been Awarded Contracts for 40 Sets of

Standard Double-Superheater Lowe Water Gas Apparatus.

PARTIAL LIST OF PLACES:

Catasauqua, Pa.
Plattsmouth, Neb.
Detroit, Mich. (2d contract).
Springfield, Ills.
Oneonta, N. Y. (2d contract).
Pottsville, Pa. (2d contract).
Evansville, Ind. (2d contract).
Lansdale, Pa.
Hempstead, N. Y. (2d contract).
New Britain, Conn.
New York, Mutual Co. (3d contract)
St. Louis, Mo. (4th contract).
Sioux City, Ia. (3d contract).
Amsterdam, N. Y.
Houston, Tex. (2d contract).
Hamilton, O. (2d contract).
Indianapolis, Ind. (2d contract).
Nanticoke, Pa.
Hazleton, Pa.
Mahanoy City, Pa.
Ludington, Mich.
Ossining, N. Y.
Lancaster, Pa.
Flushing, N. Y. (2d contract).
South Bend, Ind.
Fall River, Mass. (2d contract).
Minneapolis, Minn. (2d contract).

TOTAL SETS TO DECEMBER 31, 1905, ... 593
TOTAL DAILY CAPACITY TO DECEMBER 31, 1905, 463,780,000 CU. FT.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

ST. LOUIS GAS CONSTRUCTION CO.,

DESIGNERS AND BUILDERS OF

COAL GAS BENCHES,

SPECIAL HIGH GRADE REFRACTORY MATERIAL FOR BENCH SETTINGS AND WATER GAS LININGS.

SOLE AGENTS FOR

CHRISTY SETTINGS.

CORRESPONDENCE SOLICITED.

ST. LOUIS, MO.

FIELD'S ANALYSIS FOR THE YEAR 1904.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 36th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by
A. M. CALLENDER & CO., 42 Pine St., New York City.

ALBERT J. WEBER, President and General Manager.
Established 1846.

Adam Weber Sons.

Manhattan Fire Brick and Enameled Fire Clay Retort Works.

Works at Weber, on the Raritan River. Middlesex County, New Jersey.
GENERAL OFFICES:
Park Row Building, New York City.

Modern Coal Gas Benches,

With either Horizontal or Inclined Retorts, Half-Depth and Full-Depth Recuperative Furnaces.

ADAM WEBER PATENTS

STANDARD BENCH IRONWORK.

Linings for Water Gas Apparatus, High Grade Fire Brick of All Shapes and Sizes, Ground Fire Clay, Ground Fire Brick in Bulk or in Barrels.

ISAAC C. BAXTER, President.
Works,
LOCKPORT STATION, PA.

ESTABLISHED 1864.

JAMES GARDNER, JR., CO.,

Successor to WILLIAM GARDNER & SON.

PETER YOUNG, Secretary and Treas.
Address all communications to
JAMES GARDNER, JR., CO., Room 202 Lewis Bldg
PITTSBURGH, PA.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. PITTSBURGH, PA.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD,
1200 Bank for Savings Bldg., Pittsburgh, Pa.

NATIONAL PYROGRANIT COMPANY,

MANUFACTURERS OF

Fire Brick, Tiles, Special Shapes, etc.

NEW YORK OFFICE:
17 Battery Place, New York.

WORKS:
South River, N. J.

ESTABLISHED 1868.

L. N. RANCKE, Vice-Pres. & Mgr. F. SCHIAFFINO, Sec'y & Treas.

BALTIMORE RETORT & FIREBRICK CO.

BALTIMORE, MD.,

Manufacturers of all Material for the Construction of Coal Gas Benches.

HALF AND FULL DEPTH AND FREE FIRING BENCHES,

All styles of which we have in operation, equipped with the BEST of LATEST IMPROVEMENTS, proving our claim for SUPERIOR QUALITY and EFFICIENCY.

INCLINES—We have in SUCCESSFUL OPERATION benches of Inclined Retorts, MANUFACTURED and ERECTED by us.

WALDO BROS., 102 MILK ST., BOSTON, MASS.,
Agents for New England States.

LARGE FACILITIES—Correspondence Solicited.
RAIL and WATER CONNECTIONS to ALL POINTS.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** **The Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office: *411 Olive Street, Continental Bank,* ST. LOUIS, MO.

Bronder Patent Stoking Machinery.

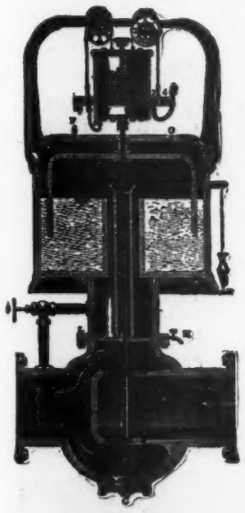
Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.
Four-Scoop and Four-Rake Charging and Discharging Machines are operating in Detroit, Mich.
These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.
Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Canada, working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

G. A. BRONDER,
Contracting Engineer and Builder,
229 BROADWAY, NEW YORK.

CONNELLY IRON SPONGE AND GOVERNOR CO.,



Design, Construction and Extension of

COAL OR WATER GAS PLANTS,

Automatic, Balance, High Pressure and Service Governors,

Roots Improved Gas Exhausters,

Iron Sponge, Purifying Material for Gas Purification, Jones Jet Photometers, Pressure Registers, etc.,

INSTALLATION OF SMOKELESS TAR BURNING SYSTEM,

Reinforced Concrete Construction for all Purposes.

Wide Experience in High Pressure Installation and Extension,

GAS SPECIALTIES.

395 Broadway, NEW YORK.

295 West 22d Street, CHICAGO, ILLS.

PARKER-RUSSELL MINING AND MFG. CO.,

OF ST. LOUIS, MO.,

PROPRIETORS OF THE

OAK HILL GAS RETORT AND FIREBRICK WORKS.

ST. LOUIS OFFICE: 417 Pine Street. NEW YORK OFFICE: Aldrich Court, 45 Broadway.

WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

SLOPERS.—We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

We Build Benches Complete. Ready for Gas Making. Also,
RETORT HOUSES,
COAL and COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates Cheerfully Furnished.
CORRESPONDENCE SOLICITED.
ALL CONTRACTS MADE AS OF ST. LOUIS, MO.
Gold Medals awarded by the Louisiana Purchase Exposition at St. Louis, for fireclay gas retorts, gas retort benches, firebrick and setting tiles.

Newbigging's Handbook for Gas Engineers and Managers. Price, $6.50. For Sale by A. M. Callender & Co., 42 Pine St., N. Y. City.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming.

A. C. M. AZOY, General Agent, 1 Broadway, New York.

JEFFREY

ELEVATING, CONVEYING, POWER TRANSMISSION MACHINERY

CATALOGUES
—OF—
ELEVATING-CONVEYING, No. 72.
RUBBER BELT, No. 67.
COAL AND ROCK DRILLS, No. 76.
MINING MACHINERY, No. 19.
With others sent postpaid on request.

IS IN GENERAL USE IN
MILLS,
MINES,
FACTORIES,
WAREHOUSES,
BREWERIES,
INDUSTRIAL AND POWER PLANTS.

WE HAVE BEEN PERFECTING OUR LINE FOR OVER TWENTY YEARS.

OUR PRICES AND DISCOUNTS ARE RIGHT.

THE JEFFREY MANUFACTURING CO.,
COLUMBUS, OH'O, U. S. A.
New York, Chicago, Boston, St. Louis, Denver.

BINDER for the JOURNAL.

Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N. Y.

SELF-INSTRUCTION
For Students in Gas Manufacture.

Price, $1.50. For Sale by
A. M. Callender & Co.,
42 Pine Street, New York City.

FRED. BREDEL, President. WM. O. VILTER, Vice-President, O. W. GREENSLADE, Secretary and Treasurer.

FRED. BREDEL COMPANY,
ENGINEERS AND BUILDERS OF GAS PLANTS.

Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.

Special High Grade Material for Recuperative Furnaces.

Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. OFFICE, 405 KEENE ST., MILWAUKEE WIS.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING,
Rooms 201 & 202. DETROIT, MICH.

Geo. Shepard Page's Sons.

GAS MACHINERY.
Correspondence Solicited.
180 Fulton Street, New York City.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

EDMUND H. McCULLOUGH, President. H. C. ADAMS, Vice-President. CHAS. F. GODSHALL, Treasurer. HENRY WHARTON, Secretary. C. B. NICHOLS, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

SUN COMPANY,

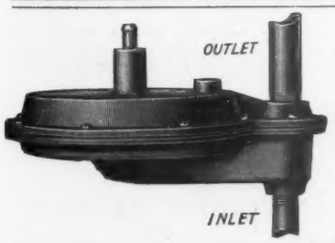
PRODUCER, REFINER, SHIPPER AND EXPORTER OF Petroleum and All Its Products.

Pittsburg, Pa., and Philadelphia, Pa.

THE SUN OIL CO.

Gas Oil, Gas Naphtha,
Refined Oil, Lubricating Oils.

Toledo, O., and Pittsburg, Pa.



REYNOLDS HIGH PRESSURE GAS GOVERNORS.

Our Governors Reduce 30 or 40 Pounds Pressure to 2 Inches Water Pressure.

WE MAKE ALL SIZES OF

DOUBLE DISTRICT GOVERNORS, INDIVIDUAL HOUSE SERVICE AND LOW PRESSURE GOVERNORS.

Write for Catalogue and State what you Need.

JOHNSON-REYNOLDS CO.,
ANDERSON, IND., U. S. A.

Standard Oil Company,

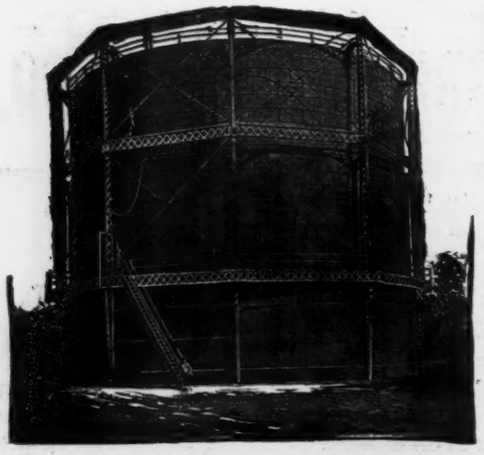
GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.



DAVIS & FARNUM MFG. CO.,

Principal Office and Works, Waltham, Mass.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, {FORT WAYNE, IND.

THE GAS ENGINEER'S POCKET-BOOK,

By HENRY O'CONNOR,

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

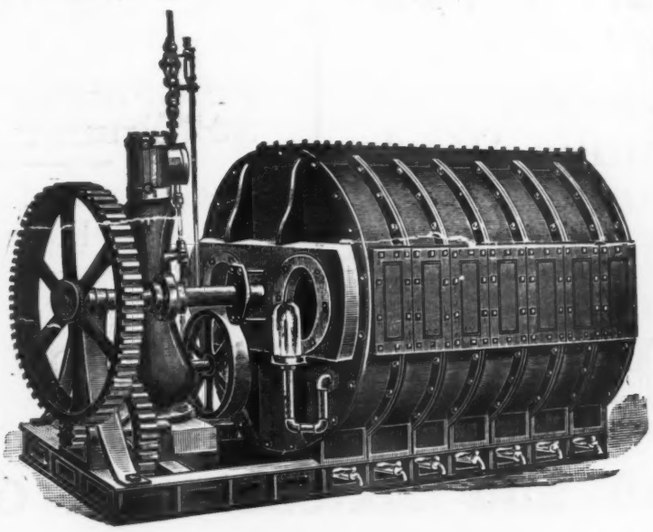
FOR SALE BY

A. M. CALLENDER & CO., - No. 42 Pine Street, New York City.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Designers and Builders of Gas Works.



Sole Lessees the Wilkinson Water Gas Process.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Disks, thus reducing the weight on shaft and power for operating same.

Coal and Water Gas Installations of the Most Modern and Complete Types.

BENCHES WITH INCLINED RETORTS.

System Stettiner Chamotte Fabrik, Actien Gesellschaft, of Stettin, Germany.

GASHOLDERS OF ALL SIZES.

General Western Agents, THE LLOYD CONSTRUCTION CO., of Detroit, Mich.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

ALEX. C. HUMPHREYS, M. E., M. Inst. C. E. ARTHUR G. GLASGOW, M. E., M. Inst. C. E.

HUMPHREYS & GLASGOW,

CONSULTING ENGINEERS.

BANK OF COMMERCE BLDG.,
31 Nassau Street,
New York.

38 VICTORIA STREET,
London S. W.,
England.

ADVICE AS TO EXTENSION AND RECONSTRUCTION OF GAS AND ELECTRICITY PLANT.

COMPLETE EXAMINATIONS MADE.
PROPERTIES PURCHASED.

R. D. WOOD & CO.,

400 CHESTNUT ST., PHILADELPHIA,

MANUFACTURERS OF

Cast Iron Pipe.

HEAVY LOAM CASTINGS,

Dunham Specials,

Hydraulic Work,

LAMP POSTS, VALVES, ETC.,

Gas Power Plants with Producers.

BUILDERS OF

Gasholders.

Single or Multiple Lifts, with or without Metal Tanks.

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

Cutler's Patent Freezing Preventer for Holder Cups.

J. S. DE HART JR. President. R. K. WEHNER, Treasurer. A. F WEHNER, Secretary

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

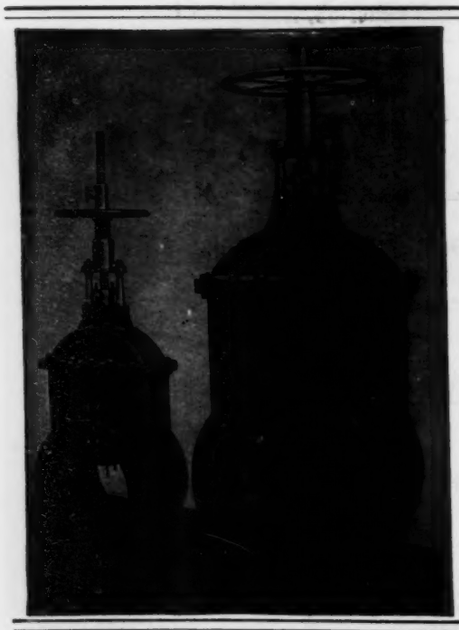
TOTAL ROTARY AMMONIA SCRUBBERS SOLD:

129,556,000 Cubic Feet Daily Capacity.

TOTAL WALKER TYPE TAR EXTRACTORS SOLD:

40,100,000 Cubic Feet Daily Capacity.

OFFICE AND WORKS: Bridge and Ogden Streets, Newark, N. J.



Double Gate Valves.

A LARGE STOCK ON HAND READY FOR PROMPT SHIPMENT.

These valves are provided with double discs or gates, and are tight with the gas pressure on either side of them.

The discs are so arranged as to be free from their seats when being opened or closed, and are operated by a quick-acting mechanism. The valve stem extends outside of the bonnet, and serves as an index, showing whether the valve is closed or open, and the amount of opening. They are made of the following dimensions:

Size.	8 Inches.	10 Inches.	12 Inches	16 Inches.	20 Inches.	4 Inches	30 Inches.	36 Inches.
Diameter of flanges.....	13 inches	16 inches.	18 inches	23½ inches	27 inches.	3 inches.	3 ½ inches	44 inches.
Face to face of flange...	12 inches.	12 inches.	12 inches	14 inches	17 inches	20 inches	21 inches.	23½ inches.

For price and other information, apply to

THE CONTINENTAL IRON WORKS,

NEW YORK (BOROUGH OF BROOKLYN).

P. O. STATION G.

Directory of American Gas Companies, 1905.

Price. $5.00.

For Sale by

A. M. Callender & Co. 42 Pine St., N. Y.

THE STACEY MANUFACTURING COMPANY,

ENGINEERS FOR THE CONSTRUCTION OF COMPLETE GAS WORKS

GASHOLDERS AND STEEL TANKS

OF ANY SIZE AND DESCRIPTION,

And All Ironwork and Apparatus Required in a Gas Plant.

Also Oil Storage Tanks, Steel Roofs, Valves, Etc.

Makers of Apparatus for THE CHOLLAR PROCESS OF GAS PURIFICATION.

MAIN OFFICE AND WORKS, - - - Station P, Cincinnati, Ohio.
FOUNDRY AND CAST IRON WORKS, 239 Mill St., Cincinnati, Ohio.

RITER-CONLEY COMPANY,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WE DON'T CARE WHO MAKES YOUR METERS

If you use the Reeves slot attachments on them. Any good make of meter combined with the Reeves attachment makes the most perfect prepay meter ever manufactured.

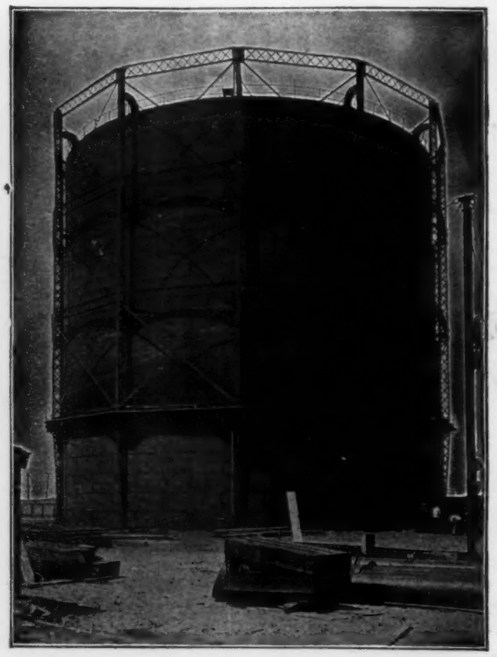
If your meter man does not handle the Reeves attachment we will supply you with the REEVES METER. Large capacity. Other important improvements. Unconditionally guaranteed.

REEVES MFG. CO., New Haven, Conn.

Newbigging's Handbook for Gas Engineers and Managers.

PRICE, $6.50.

A. M. CALLENDER & CO., 42 Pine Street, New York City.



Deily & Fowler,

39 Laurel Street, Philadelphia, Pa.

(ESTABLISHED 1842),

BUILDERS OF

GASHOLDERS,

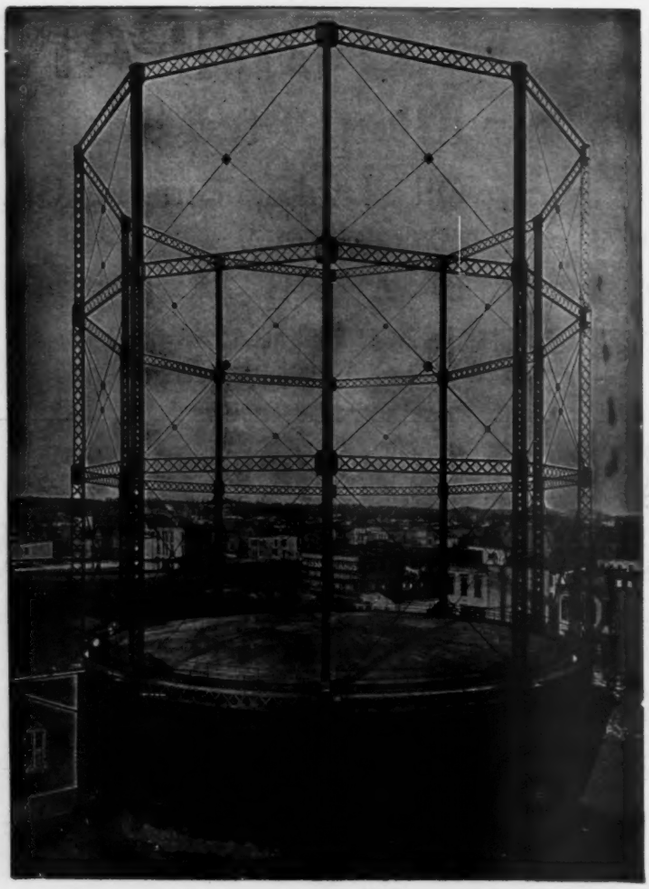
Single-Lift or Telescopic,

With or Without Steel Tanks.

Oil Storage Tanks, Water Tanks, Etc.

ESTIMATES CHEERFULLY FURNISHED.

CORRESPONDENCE SOLICITED.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 cu. ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.,

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete, with Steel Tanks.

BENCHES, SCRUBBERS,
CONDENSERS,
PURIFIERS, IRON ROOFS,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for
Complete Works.

FREDERIC EGNER,
Gas Engineer,
NORFOLK, VA.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management.

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 Cents. Orders may be sent to

A. M. CALLENDER & CO., - - - 42 PINE STREET, NEW YORK CITY.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.

"The Standard of Meter Efficiency."

GAS METERS

MADE BY

Larger Capacity

Greater Durability

PITTSBURG METER COMPANY

KEYSTONE WATER METERS.

WET AND DRY GAS METERS, PROPORTIONAL METERS AND METER PROVERS.

Main Office and Works: EAST PITTSBURG, PA.

70 PER CENT.

Of Our Output is

PREPAYMENT GAS METERS.

We have fitted up over 16,000 Idle, Regular Meters with our

PREPAYMENT ATTACHMENT.

Can be attached to any make of meter.

NATHANIEL TUFTS METER COMPANY, 8 MEDFORD STREET, BOSTON, MASS.

MARYLAND METER CO.,

LTIMORE, North and Saratoga Streets. CHICAGO, 88 to 92 Jackson Boulevard.

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

WHEN YOU SEND REPAIRS TO US

They can be changed to Prepayment, Prepayment and Beal Straight-reading, or Beal Straight-reading only. Good job. Good time. Good people. Write us.

KEYSTONE METER CO., Royersford, Pa.

New York Improved Meter Co.'s Regular Prepayment Meters are the best.

306-308-310 East 47th St., New York City.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Wet and Dry Gas Meters, Station Meters, Meter Provers, Photometrical Apparatus, Gauges,

PREPAYMENT METERS,

REGULAR METERS REFITTED WITH PREPAYMENT ATTACHMENTS.

HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

FOR SALE, NASH GAS ENGINE.

Fifty-horse power, 3-cylinder, latest type. Made by the National Meter Company. Engine can be run either on gas or gasoline. In use less than a year and as good as new. A desirable engine where natural gas is abundant and close regulation is not expected. For further particulars address

BUHL STAMPING CO., Detroit, Mich.

THE "WESTERN" APPARATUS,

THAT'S ALL.

THE WESTERN GAS CONSTRUCTION CO.,

FORT WAYNE, IND.

NEW YORK, 1707 WALL ST. EXCHANGE BLDG. SAN FRANCISCO, 410 MISSION ST.